This magazine is published to promote sound thought upon and concerning industrial medicine and traumatic surgery. To that end it will contain articles, news items, reports, digests, and other presentations, together with editors' comments. The editorial policy is to encourage frank discussion. On this basis contributions are invited.

Industrial Medicine

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Diffuse Scleroderma

—The Study of an Old Disease with an Interesting History, Easy of Diagnosis but Therapeutically Baffling, and the Treatment of which has Varied with Medical Fashions—

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TO THE medical man with a philosophic bent the disease scleroderma has a peculiar lure. Here is a disease that has been diagnosed and discerningly described for centuries, yet the etiology remains obscure. Here is a disease that the man of medicine will encounter only a few times in his career, yet its spread is as wide as the world is wide. Here is a disease that has been subjected to a series of scientific approaches which constitute a complete chronology of modern medicine, yet it is still a therapeutic enigma. Here is a disease whose name frets the mind, for it is physiologically inadequate but diagnostically ideal. Here is a disease that will reveal its secret causes and cure only to the man who has a genius for pursuing the unusual.

Scleroderma was not new to Hippocrates or Galen. The first man to diagnose it definitely was Zacutus Lusitanus in 1634; he also observed and recorded the stage of edema. In 1752 the name of Von Curzio is identified with the first full description of it. Half a century later, Willan described a case of generalized scleroderma and called it "ichthyosis cornea." Other terms were attached to it through the years and, in 1842, Gintrac hit upon "scleroderma," a poor enough name at first thought but one that grows progressively more appropriate the longer one reflects on it.

One by one many generalized systemic diseases have yielded to the ardor of this scientist or that. Scleroderma has remained secretive and aloof. In most diseases of the sort, the diagnostic stage puts up considerable resistance. But between physician and diffuse scleroderma, it is often a case of recognition at first sight. With what condition could one confuse that combination of masklike face, cold stare, clothes-pin pinched nose, claw-like hands?

The physician who has not looked into the absolute emotional void of the sclerodermatic face has little more conception of complete immobility of countenance than he has of the ultimate in mobility.

As a youth he may have watched Mansfield or Bernhardt or Coquelin at some emotional peak and have marveled at their facial frenzies. Not, however, being mathematical of mind, he has never computed the latent possibilities of expression in the normal human face. With 18 pairs and three single muscles the possible combinations in creating facial expressions reach the amazing total of 549,755,808,767. The muscles of the face are prepared to make 42 different expressions for each dollar of the War Debt. As for the patient with scleroderma—"hard skin"—he is billions of times bereft and can compete for but one role, King of the Deadpans, and a tragic role it is.

The name it bears may have changed down the centuries, but the behavior, course, and incidence of this disease have altered not at all. The treatment, however, has run the gamut of scientific endeavor. With a reminiscent smile we may scan the more recent methods, for they form a rapid orderly review of the medical discoveries since Queen Victoria, a sort of Noel Coward Cavalcade of therapeutics. (See Table I, next page.)

In Scene I we recognize the laboratory settings of the Bacteriologic and Serologic Period. Scene II shifts to the Chemical Period, with pharmaceutical, colloidal, and metabolic tableaux on a revolving stage. There follow with lightning changes the Therapeutic Period; the Mechanical (massage and baths) Period; the Electrical Period, with em-

TABLE I
FAVORED TREATMENT LISTED BY DECADES

1890-1900	1900-1910	1910-1920	1920-1930	1930-1939
Adrenalin	Mesenteric	Focal Infections:	Diathermy	Allergy
Thyroid	gland ext.	Gall-bladder	Infra-red	Ephedrine
		Prostate	Parathyroid	Fibrolysin
		Sinus	extract	Low potassium diet
		Teeth	Parathyroidectomy	Mecholyl
		Tonsils	Periarterial	Iontophoresis
		Tubes	lymphectomy	Oxygen inhalations
		Vaccines	Sympathectomy	Prostigmine
		Ovarian ext.	Thyroidectomy	Vitamines
		Pancreatic	Ultra-violet	Fever therapy
		diastase	Vacuum boot	
		Radium	X-ray	
		Testicular ext.		
		Thymus		

phasis on lights and color effects (ultraviolet and infra-red), x-ray and radium; the Focal Infection Period, with the spotlight on surgery, down to the Vitamine Period. This being a modern production, the curtain falls with the problem still debatable and the audience discussing their theories as to the logical outcome as they file out of the theater.

The various procedures, drugs, and preparations employed prior to 1895 reveal that the therapeutic field was well covered even at that day. The list is imposing and reads much like the useful portion of the pharmacopoeia of that time. The improvement and curative values noted were variable and ranged from the specificity of no therapy in which two cases were reported as cured, down to the 18% which have been reported as cured by all treatment. The inadequacies of treatment are evident on observing the data, and the variable personal factor of individual observation apparently plays a role in the estimation of worthwhileness.

FIFTY years ago the occasional medical man found it stimulating to theorize on the etiology of scleroderma; today the fascination holds, for in knowledge we have come little further. The men who theorized in the past may be commended for their logical thinking, based as it was, on the fundamentals of their time. Around 1880, Heller concluded that occlusion of the thoracic duct, with resultant damming up of the lymph flow, was the essential cause. Hebra, Kaposi, and others believed that the disease was due to connective tissue obstruction to the lymph flow. Thiral concluded that the negative pressure from menstruation held back the scleroderma-initiating substances in the body. Rheumatic fever exudate was held a cause. The view that it might be a transitional form of leprosy was ventured. Lewin and Heller, from the analysis of 450 cases in 1894, held the process to be an angio-trophic neurosis. Ormsby states that most authors have considered the disease as an angio-trophic neurosis depending upon unknown changes in the trophic center. En-

TABLE I-A
(From Lewin and Heller)

	Cure	Better	No Improvement	Total
ANTI-RHEUMATIC:				
Quinine	2	3	6	11
Salicylates	1	1	4	6
Salol	1			1
ANTI-SYPHILITIC:				
Cinnebar and Calomel	2		1	3
Iodide-Potass. Oint...			2	2
Iron Iodide	2	1	2	5
Mercuric Iodide			2	2
Potassium Iodide	2	6	17	25
Sarsaparilla	2			2
Tr. Iodine			3	3
Ung. Cinereum	4	2	13	19
DERIVATIVES:				
Fontanelle	1		1	2
Leeches	1		1	2
Venesection		1		1
Vesicants		1		1
DIAPHORESIS:				
Blanket Covering		2		2
Indian Rubber Pack..	2			2
Massage	9	8	25	42
Pilocarpine	2	1	5	8
ELECTROTHERAPY:				
Electric Baths			2	2
Faradism			1	1
Galvanism	1	5	19	25
HYDROTHERAPY:				
Alkaline	2	2	5	9
Bran and Starch			3	3
Brine and Salt		3	5	8
Cold Water	1			1
Douches	1		3	4
Hemlock	1			1
Mud and Iron	1		3	4
Pine Needle		1	2	3
Steam	6	4	12	22
Sulphur Baths	1	2	4	7
MEDICATIONS:				
Balsam Peru			1	1
Cod Liver Oil	2	3	11	16
Pyrogallate Salve		1		1
Resorcin			2	2
Salicylates	2		1	3
Salicyl-Naphthol			2	2
NERVE TONICS:				
Asafetida			1	1
Silver Nitrate	1			1
Vin, Antimony		1	1	2
NO THERAPY	2			2
	65 (18.2%)	62 (17.8%)	226 (64.%)	353

docrine imbalance as a cause has some adherents, but this does not seem to be primary.

From Lewin and Heller's earlier review, it would seem that race, nationality, or climate is a factor, for Germany, France, and England lead significantly in the number of cases reported in the literature up to the end of the nineteenth century. But let us not be deluded on that score. These countries were world capitals of medical science and research in those days. In their clinics and laboratories meticulous diagnostic work went on day and night, and the rare disease along with the widespread came in for diligent study. The present day press of waiting patients, the desire for additional fees, the lure of social success and of sports, diverted none of the attention of this school of scientists from the symptoms of the disease. Time for more study was all they asked.

A survey of the literature today quickly indicates that race is decidedly not a factor; the disease has been observed throughout the entire world. Social status may be ruled out; occupation is without effect; heredity is of no influence. Climate and season are apparently not involved.

Sex and age cannot escape the indictment so easily, particularly in the younger age groups. In patients between 10 and 20 years of age, four times as many girls are affected as boys, according to the cases reported in the literature. The larger number of women patients are between 10 and 40 years of age; among men, the incidence is highest between the ages of 20 and 50. The patriarchs among scleroderma patients were two men of 75, and also observed were two women of 73. These generalizations represent the culling of the entire literature.

Out of the 400,000 admissions to Bellevue Hospital, New York, over a given period, Cecil reported eight cases of scleroderma, or two cases per hundred thousand. A total of 508 cases had been reported in the literature up to 1894, according to Lewin and Heller. Its incidence among dermatologic cases is one case per hundred thousands as reported by Murjin and Marsnoff from a total of 18,019 skin cases.

The list of predisposing and exciting causes, as determined from the literature, is lengthy and varied. Manifestations of the disease have been noted to follow sore throats, colds, influenza, tonsillitis, and rheumatism. It is also reported as following such diverse diseases as erysipelas, angina pectoris, tuberculosis, typhus, pneumonia, diphtheria, scurvy, malaria, gout, chlorosis, scarlatina, measles, lues, Bright's disease. Occasionally it has followed psychic disturbances or bad fright. It has been observed to follow such untoward circumstances as local irritations, strains, fly bites, dog bites, dislocations, abscesses, splinters, felons, ringworm, and surgery.

When one reviews the more carefully recorded case histories of recent years, it may be significant to note that scleroderma patients generally have been assailed by acute infectious diseases, either singly or in combination, around the time of early, middle, or late adolescence. No real conclusions can be drawn because there is no consistency as to time and combination. The frequency with which the acute form follows an infection is paralleled by the thyroid insufficiency and atrophy caused by myxedema after measles and scarlet fever.

In its generalized form scleroderma progresses with considerable rapidity, two or three years being the average period before death draws the final curtain. Lewin and Heller reported that of a total of 166 cases, 45% were dead in two years and 65% in three years. In five years the fatalities numbered 75%.

From a review of 197 cases studied from the literature by Lewin and Heller one gets an idea of scleroderma's favored sites:

TABLE II
STATISTICS ON SCLERODERMA

I. Scleroderma appeared first in a study of 197 cases.

	Number of cases	Percent of total
1. Upper extremities	81	41
2. Trunk	51	26
3. Lower extremities	43	22
4. Head	22	12

II. In a study of atrophy as to localization and tissue involved, the following was found in a series of 83 cases:

	Percent of Total
1. Muscles and bones	23
2. Nose	19
3. Fat	18
4. Lips	10
5. Breasts	7
6. Ears	6
7. General atrophy	6
8. Arms	5
9. Tongue	4
10. Extremities	2

The initial appearance in 81 of these cases, or 41%, was on the upper extremities. In 51 cases, or 26%, the trunk was the point of attack, with the back of the neck, the throat, and the chest particularly vulnerable. In 43 cases, or 22%, the lower extremities entertained the first evidences of the disease, and in the remaining 22 cases the face and head were first involved.

Muscular atrophy and decalcification were present in 23% of 83 cases reviewed by the same authors. Wasting of body fat is characteristic.

He who pursues the literature will be struck by the terms the authors use to describe the condition of the skin. In a series of 66 cases, the skin condition is termed "brittle hard" in 42%; "coarse" in 27%; "hard" in 20%; "stone hard" in 9.5%; and "cartilage-like" in 1.5%.

Lewin and Heller furnish the details of distribution in 420 cases. In 23% of these cases the involvement was total; the arms were affected in 69% of the cases; the trunk, in 48%; the head in 46%; the legs in 29%.

In a total of 421 motor dysfunctions discussed in Lewin and Heller's paper, which is a resume of the literature up to 1895, the mobility of the fingers and the hands is the commonest loss, 28% of these cases being so handicapped. Restricted movement of the jaw is mentioned in 10% of the cases. The eyelids do not function in 6%; the neck

stiffens; the forehead becomes taut; the lips are retracted; all these frequently stamp the typical case of scleroderma.

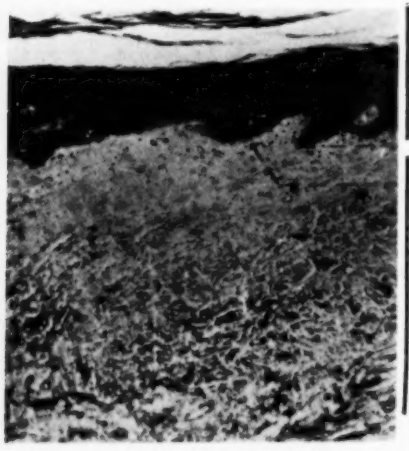
The foregoing authors also report on the character of the disorder. Data on 352 cases show 48% diffuse scleroderma; 28%, circumscribed and diffuse; and 24%, circumscribed.

The skin changes in diffuse scleroderma constitute the foremost objective finding and the changes are clearly shown in studies of the histological sections of the skin, as follows:

damage that may be charged against the disease when the following tissues are affected either singly or in combination:

NERVES: A slight thickening of the sheath with a cellular infiltration has been observed. Few axis cylinders are visible. There is parenchymatous degeneration, especially in the cervical and lumbar plexus.

BLOOD VESSELS: A narrowing of the blood vessels is followed by thrombosis with proliferation of the intima as well as of the connective tissue.



—Epidermis—Stratum { Corneum, Lucidum, Granulosum, Germinativum
—Rete pegs
—Papillae— { Nervous, Vascular
—Corium— { Pars papillare, Pars reticulare

Skin Sections

Fig. 1.

Corium — connective tissue and cellular elements. Collagen and elastin fibers present. Collagen occurs as bundles of fibers held together by semifluid interfibrillary substance, especially in the pars papillare. The collagenous bundles are only slightly extensible, but as their arrangement presents a wavy appearance on longitudinal section, they permit stretching of the skin. The elastin fibers occupy the entire corium and extend throughout the subcutaneous tissue and their chief function is that of support.

Fig. 2. **—A—** **—B—** **—C—**

THE SKIN IN SCLERODERMA:

1. *Stage of Infiltration*—hypertrophy of the collagenous fibers throughout the corium and the hypoderm, associated with vascular dilation, causing effacement of the normally wavy line made by the alternating rete pegs and papillae.

Advanced Stage of Infiltration—splitting up of collagenous bundles, decrease in the connective tissue nuclei, and absence of capillaries.

2. *Stage of Atrophy*—connective tissue gradually becoming more and more sclerotic, thinning the corium and subcutis, fat disappearing, cellular infiltration remaining only in perivascular areas, the blood vessels becoming obliterated from pressure and from inflammation of their walls. Most of them, like the hair follicles, sweat and sebaceous glands and even muscles, later become absorbed. The epidermis is thinned by pressure atrophy and the elastic tissue is mechanically altered but seldom to the point of marked destruction. There may be an increase in pigment present in either stage.

RECOGNIZED FINDINGS IN SCLERODERMA: (after Ormsby)

1. Hypertrophy of collagen, followed by atrophy.
2. Comparative absence of blood vessels.
3. Large number of dilated lymph vessels.
4. Hyperpigmentation both in rete and corium, and comparative absence of the glands of the skin.
5. Thinning of the epidermis.

[Skin Sections from KETRON, L. W., and ELLIS, F. A.: Kraurosis Vulvae (Leucoplacia) and Scleroderma. *Surg., Gynec. & Obst.*, Vol. 61. 1935.]

Scleroderma's destructive forces assault not only the skin but also involve other organs, particularly the nerves, blood vessels, muscles, bones, heart, lungs, liver, lymph vessels, thyroid gland and spinal cord. Let us review briefly some of the

There is also proliferation of the media. The intima in the veins thickens, the tunica elastica is destroyed and the intima bulges into the lumen, obliterating it.

MUSCLES: An inflation of the connective tissue

takes place, with separation of the intracellular connective tissue. The nuclei increase and the muscle appears to be separated into fibers instead of bundles. Atrophy, vacuolization and varicosities occur, with occasional spots of muscle regeneration.

BONES: The bones show secondary atrophy and inflammation resulting from the overlying ulceration. Osteoclasts are present throughout the compacta. The marrow and Haversian systems show proliferation of the surrounding cells. The periosteum grows fast to the underlying tissue, the result of perivascular infiltration.

HEART: In this organ sclerodermatic spots appear in the endocardium. Infiltration of the muscles, swelling of the myocardium and sometimes changes in the vessels take place.

LUNGS: The lungs display thickening of the pleura, localized spots of connective tissue infiltration in the lungs and pleura, leucocytic infiltration and an increase in the interalveolar connective tissue.

LIVER: Interacinous and intra-acinous connective tissue infiltration may be observed. The kidney and spleen may also show connective tissue infiltration.

LYMPH VESSELS: Complete obliteration of the ductus lymphaticus has been observed. The glands show the results of ulcerations. There is thickening of the lymph vessels and dilatation of the lymph spaces.

THYROID: No marked atrophy or enlargement of this gland have been noted, although round and connective tissue infiltration is present.

SPINAL CORD: Changes occur in the anterior root. A degeneration of the motor ganglion cells is noted; also cavities in the brain and multiple nodular thickenings in the convolutions have been observed.

In reviewing the findings of the entire number of necropsies recorded in the literature, the pathology of the disease seems to lend itself more easily for comparative purposes to lues, than to any other disease.

During its clinical course, scleroderma has often and easily been confused with lues; especially did this occur before the advent of the Wassermann test. One must remember that there have been recorded comparatively few cases of scleroderma over a long period of years, in relation to the large number of luetic reports by many workers. Therefore, the chronicity, the amount of skin involvement and other factors are not well established. On the other hand, many of the cardinal, well-

TABLE III

COMPARATIVE FINDINGS IN 25 NECROPSIES—EACH OF SCLERODERMA AND SYPHILIS

SCLERODERMA			LUES
		BRAIN	
	....	Arteriosclerosis	1
1	....	Cortical atrophy	
1	....	Congestion	
1	....	Dura Mater—adherent	
1	....	Induration—gyrus	
1	....	Softening	2
	....	Thrombosis	1
		HEART	
	....	Aortitis	25
	....	Coronary Sclerosis	4
4	....	Degeneration—	5
	....	myocarditis	
1	....	Dilatation	8
2	....	Hypertrophy	15
1	....	Mitral—sclerosis	2
4	....	Myocardium—	1
	....	cloudy swelling	
5	....	Pericarditis	2
1	....	Thrombosis—	1
		pulmonary artery	
		INTESTINES	
2	....	Congestion	
1	....	Tb Abscesses	
		JOINTS	
	....	Ankylosis	1
1	....	Arthritic roughening	
	....	Fluid	1
		KIDNEYS	
1	....	Arteriosclerosis	2
	....	Degeneration	2
1	....	Infarcts	
	....	Nephritis	8
1	....	Sclerosis	
		LIVER	
3	....	Cirrhosis	2
	....	Degeneration	4
2	....	Enlarged	
	....	Gumma	1
1	....	Hepatitis	
1	....	Hyperemia	1
		LUNGS	
	....	Abscess	1

SCLERODERMA			LUES
2	....	Adhesions	5
3	....	Bronchopneumonia	5
2	....	Edema	10
5	....	Fluid—pleural	9
2	....	Hyperemia—passive	9
2	....	Pleura-pericardium	1
		thickening	
3	....	Tb.—nodes, apices	9
2	....	Tracheitis, bronchitis	3
		MUSCULATURE	
5	....	Atrophy—pale	
1	....	Dense and fibrous	
	....	Diaphragm	2
		PERITONEUM	
	....	Abscess	2
1	....	Ascites	10
1	....	Hyperemia	
1	....	Peritoneal adhesions	7
		SPLEEN	
1	....	Adhesions	
1	....	Atrophy	2
	....	Gangrene	1
	....	Hyperplasia	2
3	....	Hypertrophy	
	....	Hyperemia	5
		STOMACH	
	....	Carcinoma	1
	....	Fibroma	1
	....	Gastritis	2
1	....	Gastro-enterostomy	
	....	Ulcer	3
		ADRENALS	
	....	Adenoma	1
		BONE CHANGES	
	....	Deformities	1
1	....	Necrosis	
		GALL BLADDER	
	....	Concretion	1
		PALATE	
	....	Perforation	1
		SKIN	
2	....	Ulcers	1

recognized lesions of syphilis became known only through the compilation of overwhelming numbers of cases that came to postmortem examination.

Furthermore, a comparison of lues and scleroderma sharply silhouettes the fact that new methods and discoveries have added greatly to the treatment and control of the one, while they have been distressingly ineffective in the other. Not one of the methods, earlier summarized, has been sustained long beyond its period of initial trial, there being insufficient evidence to warrant its continued use.

In Table III is a comparison of the necropsy findings in various organs in 25 cases of scleroderma and in the same number of luetic cases. Death of a scleroderma patient is indirectly the result of secondary disease. The direct cause from the disease is marasmus. There are degenerative lesions of the heart, lungs, and nerves. Osler observed that the termination may be abrupt.

IN NATURE and in art when dark areas and light are juxtaposed, there is produced an effect of dramatic intensity. The painter El Greco thus made the heavens full of portent, poetry, and emotion. Now and then it is given to the man whose art is medicine to experience poetic emotion and a feeling of portent, when with dramatic swiftness, black despair breaks and white hope shines through.

To one with a long sustained mental fervor regarding scleroderma, intensified by the fatal termination of two previous cases, there has recently come a streak of light across the dark prognostic sky, a phenomenon that has been the immediate inspiration of this monograph. Perhaps a little of the emotional lift experienced can be suggested by a comparison of a typical case from the literature with the author's most recent case.

As indicated in Table IV, the two cases selected for comparison are surprisingly similar, showing continued loss of weight, followed by loss of strength, induration of the skin, increasing weakness, development of the "Sclerodermique Masque," stooping gait, prominent loss of weight over the arms, difficulty in swallowing (a complication often mistaken for myasthenia gravis), pigmentation of the skin of the chest and sclerosis of the skin of the face, hands, and arms.

Identical symptoms received much different treatment. One patient underwent the massage typical of his period; the other, the hot and the fever baths, the oxygen inhalations, the diets and the newer drugs of the present day.

The records of the case from the literature end somewhat typically: "And sudden death." Against this dark picture has been posted the record of the other case: "And sudden improvement."

The second case had advanced until death apparently could be deterred only a few days more. Finally, a new type of parenteral acid therapy, conspicuously successful in preliminary trials on arthritis, was employed. Within a week the pa-

TABLE IV

COMPARATIVE SYMPTOMATOLOGY OF TWO CASES

Case in Literature	Author's Case 3
1. Good intelligence.	1. Good intelligence.
2. Negative past history.	2. Negative past history.
3. Loss of weight.	3. Loss of weight—40 pounds.
4. Loss of strength—14 months.	4. Fatigue and weakness—10 months.
5. Induration of skin—20 months.	5. Induration of skin—nine months.
6. Unable to raise head—five months.	6. Five weeks in hospital at Mayo Clinic. One week at St. Luke's Hospital, Chicago.
7. Marked wasting of muscles—head and side of neck, shoulder girdle, and trunk muscles.	7. Generalized muscular weakness involving head, neck, trunk, and extremities.
8. Unable to move without assistance.	8. Unable to move without assistance.
9. Pale, weak, and emaciated.	9. Poorly nourished, pale, and emaciated.
10. Could not raise legs or turn over without assistance.	10. Could not raise legs or turn over without assistance.
11. "Sclerodermique Masque."	11. Expressionless stare.
12. Gait became stooped.	12. Forward inclination in walking.
13. Arms—smaller.	13. Arms—smaller.
14. Some difficulty in swallowing.	14. Dysphagia, partial tracheal aspiration.
15. All movements limited to feeble motions.	15. Restricted muscular efforts, tired easily.
16. Slight thickness of speech.	16. Partial aphonia.
17. Skin of neck, hands, lower forearms showed moderate induration and pigmentation. Slight discoloration of skin on chest.	17. Discoloration of skin on chest.
18. Hardening of skin of face, back of hands, and wrists.	18. Hardening of skin of face, hands, abdomen, and arms.
19. Massage and passive movements—exercise.	19. Addison's low potassium diet. Oxygen inhalations. Fibrolysin. Prostigmine—oral and subcutaneous. Massage, heat and exercise. Thyroid and salicylates. Vaccines.
20. Extent of improvement—could not walk without assistance.	20. Unimproved — dysphagia with occasional tracheal aspiration of liquids. Bedridden, and partial aphonia, and could not move without assistance.
21. And sudden death—	21. Gain in weight to 121 pounds under Aciform therapy. Up walking with no fatigue. Stronger voice, no complaints. Appetite excellent and no dysphagia. Partial improvement in hands, some softening of the skin of the abdomen and decrease in pigmentation on the chest.

tient's most distressing symptoms had improved or abated. The patient was dramatically removed from the role of a complete invalid at death's door to a condition of improvement so that he was able to be up unaided.

CASE 1.

Scleroderma, a comparatively rare disease, easy of diagnosis but of obscure etiology and, therapeutically, an enigma. It has baffled science for centuries. As its name indicates, a "hard, indurated" skin is always a pronounced symptom but its destructive forces are far-reaching, as the illustration shows. This patient weighed 75 pounds at the time she succumbed.

The full history of the author's case which inspired this article will be given, but first, a summary of the histories and findings of the author's first two cases will be presented.[1]

CASE 1. S. R., a widow, Bohemian, aged 35 years, was admitted to the hospital in August, 1920. There was diffuse brawny induration of the skin of the upper extremities and jaw, with a resultant limitation of motion; a corpse-like appearance to the face; brown pigmentation and leucoderma of the skin of the body in general; sclerodactylie; slight nocturia and a burning sensation upon urination; marked loss of weight; susceptibility to colds and exposure; weakness.

HISTORY: Five years previously, the patient stated, the skin of the hands gradually began to redden and later to become rigid and pigmented. The arms, too, were affected and stiffness and tension characterized her movements. In time the jaw became involved, the condition leading to difficulty in talking and chewing. Swallowing, fortunately, was not a struggle. As time went on, the brown pigmentation travelled more or less over the body, with patches of pearly white depigmentation to furnish clownish contrast. Painless swelling affected the fingers, and as the swelling hardened, the fingers were "frozen" into a flexed position. Occasionally, rheumatic pains visited the knees and the scapulae. From a normal weight of 130 pounds the patient wasted to 75 pounds. Four or five of my colleagues were consulted but the proper therapy eluded them.

The past history recorded measles in childhood; much tonsillitis up until the time of a tonsillectomy three years prior to her hospitalization in 1920. One year later, an appendectomy, this being followed by influenza.

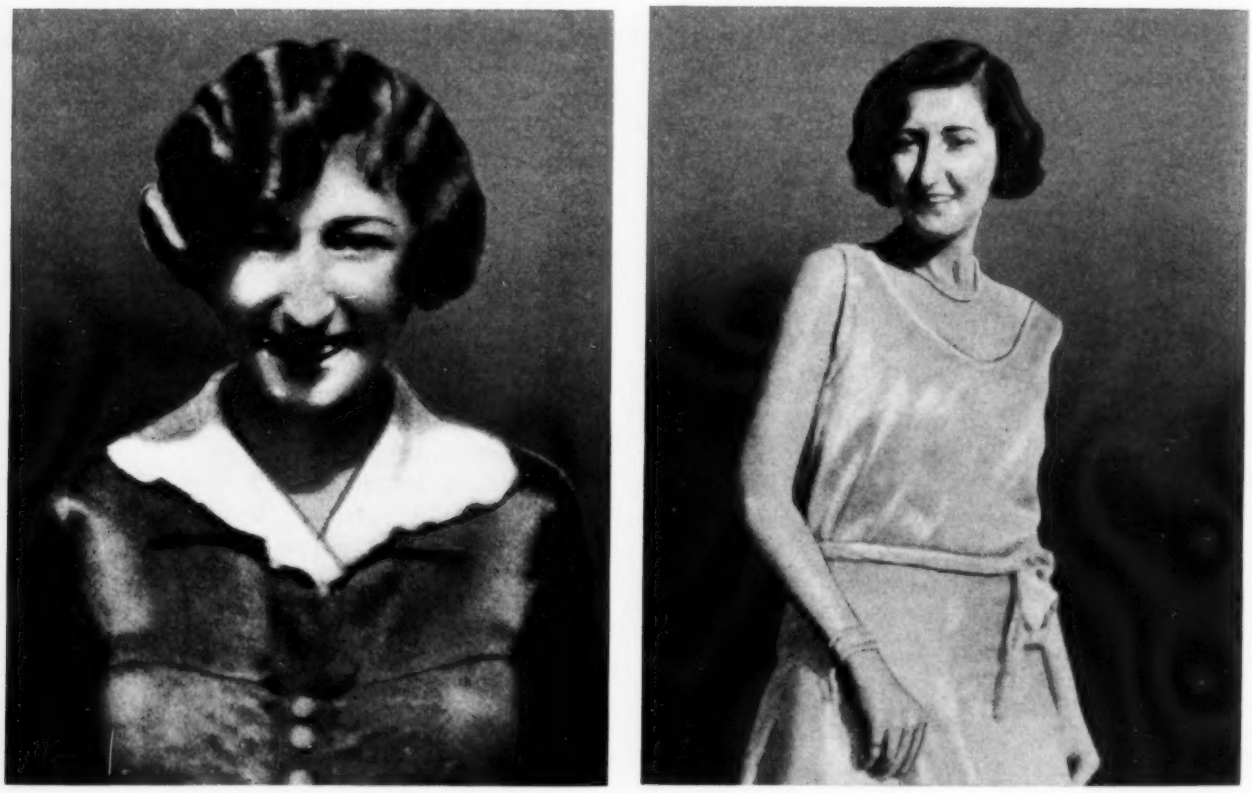
PHYSICAL EXAMINATION: The skin of the upper extremities and the jaws was thick, waxy, and reddish brown. The hands were deformed into fearsome claws. Along the fingers, especially about the joints, tiny nodules appeared, some covered with whitish patches. All the nails had come off, and there was only slight evidence of any nail regeneration. Owing to winter chilling, "sores" would appear at the proximal interphalangeal joints. The patient was unable to extend the arms completely at the elbows. The lower extremities were not involved. The teeth were in wretched carious condition, and the eyesight was poor. Other physical findings were not of apparent significance.

Treatment in 1920 consisted of the removal of several carious teeth and in the course of removal, the angle of the mouth was lacerated, requiring suturing. Thyroid was administered in broken doses by mouth but, due to the inability of the patient to tolerate the discomfort and increased pulse, the therapy was discontinued after a few weeks. Corpus luteum extract by mouth and by injection was given over the period of a year with no change in the course of the disease. Anterior pituitary extract was given twice weekly for several months with no apparent change. Supplementary iron by mouth was given for the secondary anemia encountered. The weakness progressed and the patient was hospitalized with no immediate change in her condition. She was confined to her bed for an additional month during which time she continued to waste away and she

1. It was DR. FRANCIS SENEAR, Professor and head of the Department of Dermatology at the University of Illinois School of Medicine, who inspired my original interest in the problem of scleroderma, and it is to him that I am indebted for my first case as well as helpful suggestions in the preparation of this manuscript.

succumbed to generalized weakness and inanition.

The autopsy findings revealed the changes common to generalized scleroderma. The skin manifested changes of atrophy, scattered areas of hyperpigmentation in the rete, and increase in collagen in the corium, together with a narrowing and partial obliteration of the blood vessels. The thinning of the epidermis was generalized and the distal phalanges showed evidences of subacute reaction to the ulcerations present about the nails. The heart showed evidence of cloudy swelling and the presence of thrombosis of the right pulmonary artery. Hyperemia of the intestines, normal kidneys and spleen, and the adrenals were well developed with some evidence of increase in fat, the medullae being well developed. Liver showed no changes, the aorta revealed fatty degeneration of the intima, and there were small retroperitoneal and mesenteric lymph nodes. Ankylosis of the temporomandibular joints.



CASE 2.

This photograph was taken before the devastating effects of scleroderma had become pronounced but emaciation can already be detected. In the second picture the disease has made some progress. The fingers are "freezing," the elbow joints have lost their elasticity, the nose is pinched, and the skin is becoming taut over the bones. Treatment was long and varied, according to the fashion prevailing at the time, but at 29 she collapsed from weakness and exhaustion.

CASE 2. K. W., an unmarried woman, aged 29, entered the hospital for a laparotomy. At this time she was under observation for atrophic rhinitis and scleroderma from which she had suffered since she was 16 years of age. Following her recovery from the operation, she was advised to seek a dry climate and went to Phoenix, Arizona. Thirteen months later the patient returned to the hospital.

COMPLAINT: The Arizona climate had served to aggravate all her symptoms. Throughout her stay she had suffered pain and stiffness of the joints and a raw, parching sensation took up residence in the nasal passages. These symptoms disappeared on her return to a low, moist climate.

Five months before her second visit to the hospital, following a siege of toothache, several molars were extracted. Pain in the jaws and discharge from the sockets persisted for an extended period.

PHYSICAL EXAMINATION: The patient was emaciated and had marked atrophy of the skin and deformity of the joints. Lack of subcutaneous fat was apparent over the entire body. The thin, glossy, atrophic skin was stretched taut over the bones, and the bony prominences appeared to be pushing through. Over these areas, subcutaneous hemorrhages were in evidence. Over the face and neck, the skin was covered with a fine macular erythematous eruption.

Eyelids were paper thin; the nose seemed to bear the prints of a clothes pin so evident was the lack of fat in the alae; the mucous membranes were dry, reduced, and desquamated. Elbow joints were static with the arms at right angles. Extremely deformed hands gave evidence of atrophic arthritis, progressive and ankylosing.

TREATMENT: Thyroid therapy was not well tolerated by the patient and was discontinued after a short time. Vitamines were administered over a long period and the patient was sent to the Southwest for a more equable climate. She failed to improve and she returned after an extended stay

in a weakened condition. Symptoms referable to the stomach and the gastro-intestinal system became marked because of her inability to take any nourishment. The emptying time of the stomach was 18 hours and in the course of the gastro-intestinal series work-up, the barium used became a problem because of the extreme atony of the intestines. The inanition increased and the patient became weaker, so that a posterior gastro-enterostomy was performed in the Fall of 1935. No pathological lesion was demonstrable and the diagnosis remained a functional sympathetic disorder. The atony remained marked after the operation and complicated the postoperative course. The patient failed to improve and, 10 days after leaving the hospital, died of weakness, exhaustion, and generalized wasting.

The skin changes found at postmortem were typical with the presence of thinning of the epidermis, flattening of the normally wavy line of rete pegs and papillae, hyperpigmentation of the rete. Decrease in size and number of blood vessels, and the corium and the subcutaneous tissue were firm and inelastic showing an advanced stage of atrophy with marked fixation to the underlying tissues. Catarrhal tracheitis and bronchitis with hypostatic bronchopneumonia, together with areas of atelectasis of lower lobes and passive hyperemia. Chronic fibrous adhesive pericarditis, fibrous changes in the mitral valve, and a patent foramen ovale. Previous operative field revealed a healed and patent gastro-enterostomy, and there were hyperemia and fibrous adhesions between the colon, gall-bladder, diaphragm, and chest wall. Kidneys showed fetal lobulations. Spleen normal and the adrenals essentially normal. Epitheliosis of the esophagus present.

CASE 3. K. T., an unmarried male, aged 22, was first seen August 5, 1938. The complaints were generalized scleroderma, dysphagia, vomiting, choking, anorexia, extreme weakness, and constipation. These had been progressive over the preceding nine months.

ONSET AND COURSE: A college student, alert in his studies, he was also a wrestler and a swimmer and these activities served to accentuate a growing tendency to tire easily. The fatigue became progressively severe, and a marked muscular weakness crept over the arms and thoracic region.

Loss of weight was soon noticeable, at first principally above the waist. The hands began to swell and soon purple and white blotches appeared on the skin of both hands and feet. A certain clumsiness of gait began. About the same time an excess of saliva and mucus brought about an occasional choking sensation. The tone and quality of the voice altered, followed by rapidly progressive failure of the vision.

During the period of nine months before the patient was first seen, he had three severe chills followed by fever and coupled with severe gastro-intestinal upsets with nausea and vomiting. Stubborn constipation set in. Swallowing became difficult, and food, once swallowed, had no inclination to remain in the stomach. The patient began to vomit as frequently as once a day. Repeated coughing spells raised quantities of mucus, phlegm, and saliva. The appetite was poor and the young man's weakness became such that he could not raise his head unaided. Foods, especially liquids, were occasionally aspirated into the trachea.

Over the face and the extremities the skin was pale, hard, tight as a drum, and cold to the touch. His expressionless face could be described only as a "cold stare," for under the skin the muscles, too, were atrophic. The orbits were prominent; the lips were cold and colorless, and so thinly drawn as to expose the teeth. The nose was Pinocchio-long and pinched.

A peculiar hard swelling had enlarged the hands to twice normal size, and there was no closing the contracted fingers. Over the rest of the body, the skin was tough, dry, and closely attached to the underlying parts. The upper anterior chest was discolored brown with thickened, inelastic subcutaneous tissue.

Muscles of the arms and hands were somewhat atrophic and very spastic, and the feet were affected in less degree. It was noted that the libido was absent and at no time was there priapism or nocturnal emission.

PREVIOUS TREATMENT: In February, 1938, K. T. went to the Mayo Clinic, where his condition was diagnosed as scleroderma. A study of the capillaries showed greatly dilated loops with a decreased number in the field, some bizarre distribution and an earthworm type of blood flow. The sweating test showed sweating everywhere except in the distribution of the mid-branch of the trigeminal nerve. An autogenous vaccine was made from his mucus and administered. Hot and fever baths were instituted but these caused such loss of strength that they were discontinued. Prostigmine was ordered and administered as were glycine and ephedrine. The two last named were shortly discontinued because they made him ill, but the prostigmine was continued subcutaneously.

In June, 1938, he was able to be up and about, but the progressive loss of strength and weight continued; nor was there any change in the incidence of the gastro-intestinal upsets. By this time, rapid deterioration of the muscles of the entire body, more particularly in the legs, was evident. Following a chill accompanied by fever and a severe gastro-intestinal upset, he vomited large quantities of bile and the fluid contents of the stomach. With the onset of this attack, he returned to the Mayo Clinic where he remained in bed. Over a five-week period of investigation, the temperature ranged from 99.5° to 102°. The urinalysis was normal; the blood studies showed:

Hemoglobin	14.2 gm.
Eosinophiles	6. %
Erythrocytes	4,580,000
Monocytes	6. %
Reticulated cells	.4%
Leucocytes	9600.
Neutrophiles	62. %

The blood smear showed a slight generalized

macrocytosis of the red cells. Flocculation tests on the blood were negative.

Urea	30. mg.
Bilirubin	1.2 mg.
Chlorides	575. mg.

The carbon dioxide combining power was 61.7 volumes percent; the van den Bergh was absent.

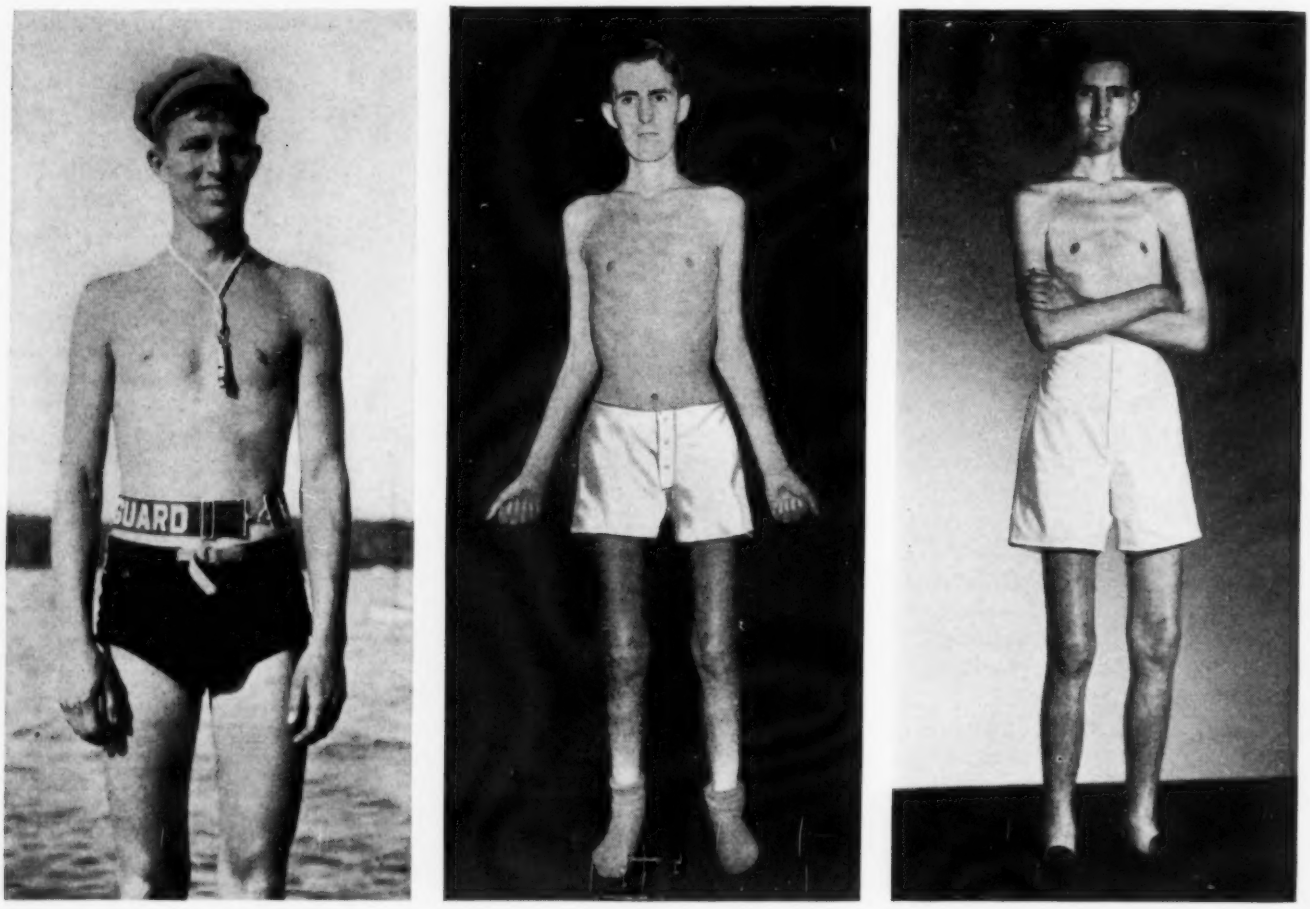
Blood calcium	10. mg.
Blood potassium	20.7 mg.
Blood sodium	305. mg.

The sedimentation rate was 13 mm. per hour. The basal metabolic rate was a —14.

ture. He was treated with fibrolysin but during the course of the treatment he had a fever and chill which lasted for two days with an associated gastro-intestinal upset. His condition subsequently remained unimproved and at the end of the fifth week, he was dismissed from the Clinic. Immediately upon his return to Chicago, he was sent to St. Luke's Hospital on a stretcher where he was seen for the first time.

PHYSICAL EXAMINATION: The general findings were:

Weight, 105; height, 5 ft. 11 in.; temperature,



CASE 3.

A college student, aged 22, alert in his studies and inclined to athletics, particularly wrestling and swimming. The first indications of that which developed rapidly into scleroderma took the form of fatigue which was speedily followed by muscular weakness, noticeable in the arms and the thoracic region. The husky young student became an invalid. One month before the center picture was taken, he was carried into St. Luke's hospital on a stretcher, and it was apparent that the disease was progressing rapidly toward what was considered the inevitable conclusion. Aciform II was given daily during the first week, and on the sixth day he was able to sit up, leaving the hospital on the tenth day. The photograph reveals the inwardly curved and set fingers, the marked emaciation, and his mask-like face. The third picture was taken five months later after the treatment had been continued twice weekly. His improvement in strength and endurance was in marked contrast to his previous condition. His face shows improvement in contour and greater range of mobility. Gain in weight of 18 pounds and increased motion in the fingers reflected the improvement.

Prostigmine by mouth was ineffective, but following subcutaneous injections twice daily, the vomiting stopped and the temperature remained normal. Vomiting and temperature change recurred immediately with the omission of the prostigmine.

Addison's low potassium diet was ordered but brought no improvement. Oxygen was used for a period at which time he gained slightly, eating more heartily with no vomiting or rise in temperature.

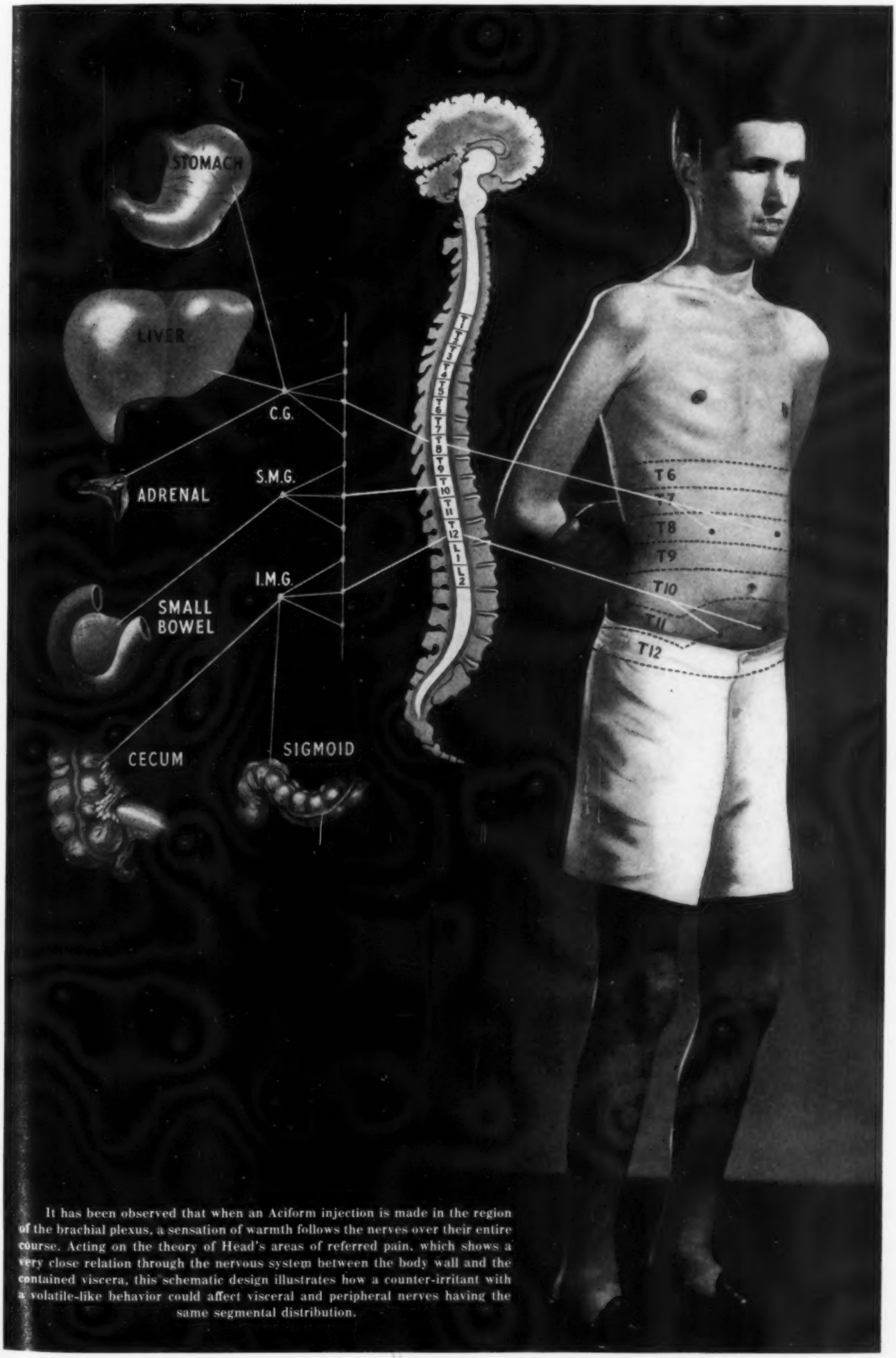
97.0°-99.2°; respiration, 16-24; pulse, 64-100; blood pressure, 96/70.

The regional findings were as follows:

HEAD: No deformities or scars; no areas of alopecia; scalp seems fixed; hair somewhat dry.

FACE: Expression mask-like; skin tightly drawn, pale, cyanotic, glistening, and difficult to pick up; eyes prominent and palpebral fissures widened.

EYES: In April, 1938, 5% loss of vision. A one-degree cylinder of minus was brought up to 20/30



It has been observed that when an Aciform injection is made in the region of the brachial plexus, a sensation of warmth follows the nerves over their entire course. Acting on the theory of Head's areas of referred pain, which shows a very close relation through the nervous system between the body wall and the contained viscera, this schematic design illustrates how a counter-irritant with a volatile-like behavior could affect visceral and peripheral nerves having the same segmental distribution.

vision for distance. Fundi normal. In November, 1938, unable to read and objects appeared blurred. R.E.: 20/40 (20% loss of vision); L.E.: 20/50 (25% loss of vision). Fundi examination revealed a migration of pigment cells in the left macular area. Retina not thinned or scarred. A plus 1.00 glass needed for reading. Eyes had aged 20 years in a few months. Pupils equal and react to light and accommodation. External ocular muscles intact. No exophthalmos; no lid lag; no widened palpebral fissures.

EARS: Hearing and drums normal; no discharge or obstruction.

NOSE: No deformities, obstruction, or discharge; septum straight.

MOUTH: Tonsils removed; lips are colorless and cyanotic and there is a forced unnatural movement of the lips during conversation. When the face is in repose there is retraction of the upper lip so

CASE 3.
The sclerodactylic hands are flexible and useful after six months' treatment. The typical glistening, pallid, tightly-drawn, and cold-dry skin, however, still persists.

that the teeth and the margin of the gums are exposed. Teeth in excellent condition, tongue coated, pharynx is pink and healthy looking.

NECK: Motion is limited; no enlargement of the lymph glands or the thyroid; no abnormal pulsations of the blood vessels.

CHEST: Over the anterior surface is a brown pigmented area about the size of the palms of both hands in much the fashion of a bib. Scattered through the pigmented area are multiple whitish and yellowish patches. These areas are smooth and over the entire pigmented area the skin gives the impression of stiffness.

LUNGS: Equal, though limited, in expansion; clear and resonant. No exaggeration of vocal or tactile fremitus; abdominal type of breathing.

HEART: Normal in size, shape, position, rate, and rhythm; heart rate, 100. Apex beat synchronous with the wrist; no accentuation of second pulmonic or aortic sounds. Two sounds present at the apex and two at the base. No thrills or murmurs.

ABDOMEN: Scaphoid in appearance; no masses, tenderness, or rigidity. Considerable spasticity over the cecum and sigmoid; no tenderness over the gall-bladder; liver, spleen, and kidneys not palpable. Skin thick, leathery, and difficult to pick up; there is considerable difficulty in hypodermic injection of the abdominal wall.

RECTUM: Prostate of normal size and consistency. No hemorrhoids or fissures.

GENITALIA: Normally developed; no scars or deformities; testes normal.

GROIN: No herniae or lymphadenopathy.

BONES AND JOINTS: Pathology confined chiefly to the hands, with a cold, hard, non-tender swelling. Fingers show flexion contracture; tips cannot be touched to the thenar eminences of either hand.

MUSCULATURE: Muscles reduced in size and function; considerable spasm; very atrophic. Elbows not extensible; leg muscles flaccid and atrophic; similar atrophy of the facial muscles.

EXTREMITIES: Similar, hard, non-tender swelling in both hands and feet; muscles very atrophic; flexion contracture of the fingers.

LYMPH SYSTEM: No enlargement of the inguinal, cervical, or axillary glands; epitrochlear not palpable.

SKIN: Glistening, pallid, tightly drawn, inflexible, non-pliable, cold, dry, and darkly pigmented areas. An area of brown pigmentation is present over the upper anterior portion of the chest in much the formation of a bib down to the level of the third interspace. Perspiration inhibited over all body surfaces.

NERVOUS SYSTEM: Reflexes greatly diminished; can scarcely be elicited. No aphasia; Romberg sign negative; gait clumsy; no tics or paralysis. The following neurological findings were essentially normal:

Pathological: Babinski, Gordon, Oppenheim, Chaddock.

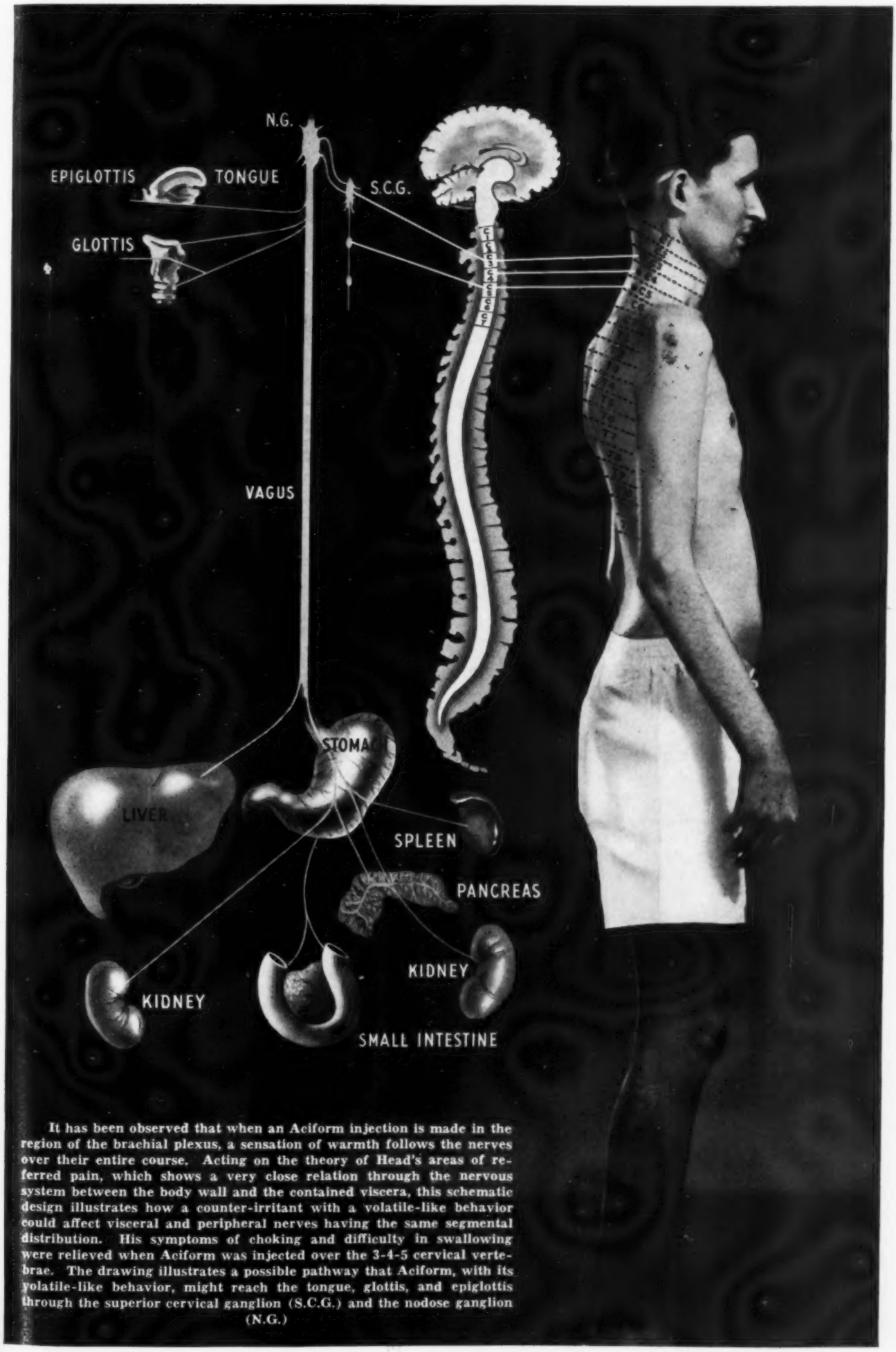
Deep: Patellar, Achilles, Triceps, Biceps, Radial, Ulnar.

Superficial: Abdominal, Cremasteric.

Cranial: Eyes (light and accommodation); Pharyngeal.

TREATMENT: On August 16, 1938, the new parenteral acid preparation, Aciform II, was injected at sites over the abdomen and along the 3-4-5 cervical vertebrae. Injections over the abdomen were ½ cc. each (see p. 453), while along the cervical vertebrae, injections were ¼ cc. each (see p. 455). For the first 10 days, treatments were given every day; since that time, injections have been made twice weekly.

After the first 24 hours, the extreme prostration disappeared. He could complete a sentence that he started, he could take more frequent swallows of milk, and swallow more at one time without it regurgitating through his nose. On the third day he was taking decidedly more nourishment, talking more with less fatigue, and changing his position in bed without the aid of a nurse. There was noted a decided change in fatigue following an enema. The sixth day found him sitting up on the back rest most of the day and he noticed a change in his ability to hold up his head, together with



It has been observed that when an Aciform injection is made in the region of the brachial plexus, a sensation of warmth follows the nerves over their entire course. Acting on the theory of Head's areas of referred pain, which shows a very close relation through the nervous system between the body wall and the contained viscera, this schematic design illustrates how a counter-irritant with a volatile-like behavior could affect visceral and peripheral nerves having the same segmental distribution. His symptoms of choking and difficulty in swallowing were relieved when Aciform was injected over the 3-4-5 cervical vertebrae. The drawing illustrates a possible pathway that Aciform, with its volatile-like behavior, might reach the tongue, glottis, and epiglottis through the superior cervical ganglion (S.C.G.) and the nodose ganglion (N.G.)

less aching in the shoulders and arms. On the seventh day, he felt strong enough to be up and about, and he sat around in a chair for a few hours, both in the morning and afternoon. The eighth day he took several short walks up and down the hospital corridor, and on the tenth day he felt strong enough to leave the hospital. Following this he was given Aciform II therapy twice a week at the office.

In the middle of September, he had dinner in a Chinese restaurant, following which he had a night of nausea, vomiting, and diarrhea. These symptoms soon disappeared and the Aciform II therapy was continued. Around October 10, he had another attack of emesis, and subsequently experienced constipation. Heavy foods seemed to disagree with him, but he no longer reported difficulty in swallowing and the choking spells seemed almost to have disappeared.

Strength and weight were returning gradually, and simultaneously came a noticeable change in the flexibility of the skin, especially of the trunk, together with a slight depigmentation of the anterior portion of the upper chest. The skin was losing its leathery texture, and he could wrinkle his forehead and could move his hands more freely. He was able to get out of chairs unassisted and with considerable ease. The weight continued to increase, the hands were slightly warmer, and the increased mobility was maintained.

THE laboratory, productive of revealing clues in the detective work on most diseases, has been singularly impotent in dealing with scleroderma. To hosts of tests to which patients have been submitted there is apparently no telltale chain of evidence linking one patient with another. We find the following tests offering no aid in furthering the successful treatment of scleroderma or in the discovery of the etiological factors: hormone content; Abderhalden's reaction; response to vacuum; capillary estimation; blood chemistry (urea, nonprotein nitrogen, creatinine, creatine, chlorides, potassium, sodium, calcium, bilirubin, carbon dioxide combining power); sedimentation rate; basal metabolic rate; urinalysis; blood count; sweating; allergy; Wassermann and Kahn reactions.

Some of the disorders with which scleroderma has been confused include: acrosclerosis; acrodermatitis atrophicans; Buerger's disease; dermatomyositis; ichthyosis; lepra; morphea en plaque; morphea guttata; Morvan's chorea; Raynaud's disease; sclerema edematosum; syringomyelia; vitiligo; xeroderma pigmentosum.

To assist in making the differential diagnosis between scleroderma and these diseases some distinguishing characteristics of the other diseases will be reviewed. Acrosclerosis, for example, arises on the hands and on the face at the same time. Vasomotor changes produce a mottling of the skin. Patients complain of pain in cold weather and the bones of the fingers usually show shrinkage and drying. The skin becomes taut but it remains soft to the touch.

Acrodermatitis atrophicans, in women, starts as soft, bluish, edematous infiltrations of the legs or the arms, sometimes referred to on the arms as "ulnar stripes." The skin is wrinkled, dry, and attenuated.

Ichthyosis appears only when there is a congenital history of the disorder. Moreover, there is absence of induration.

Ormsby describes lepra as distinguished by pigmented macules and atrophic patches which present anesthetic and hyperesthetic symptoms. A coincidence with bullae, nodules, ulcers, and involvement of other organs will be noted.

Morphea en plaque is characterized by roundish sclerodermatic plaques circumscribed with a lilac ring. Morphea guttata, or white spot disease, is localized and no lilac ring is present. It heals with scarring.

Scleredema adultorum begins on the nape of the neck and on the upper part of the arms. It never travels to the feet or to the face although it may reach the abdomen, and on rare occasions, the lower extremities. Infectious disease usually precedes the onset.

In vitiligo there is conspicuous absence of structural changes in the skin.

Xeroderma pigmentosum is characterized by hyperpigmentation and warty growths. There are telangiectatic areas and the disease is limited to exposed areas.

Scleroderma's complications are sundry. A list of these and of the accompanying conditions found in a review of the literature includes the following: acrosclerosis, Addison's disease, alterations of the superficial vascular network, annular scleroderma of the pelvis, Basedow's goitre, bullous and gangrenous erysipelas, calcium gout, chronic polyarthritis, chronic fibrous rheumatism, cachexia with pluriglandular lesions, diffuse sclerosis of internal organs, decrease or absence of free gastric hydrochloric acid, esophageal stenosis, erythromelalgia, exophthalmic goiter, facial basocellular epithelioma, gangrene of the finger, hemorrhagic diathesis, herpes zoster, hypocalcemia, facial hemiatrophy, increased basal metabolic rate, hepatic derangement, osteomalacia, psychosis, paroxysmal eye trouble, paralysis agitans, pregnancy, retraction of palmar aponeurosis, subcutaneous calcareous concretions, syphilis, tendovaginitis crepitans, traumatic total hemiatrophy, tuberculosis, transformation into chronic dermatitis atrophicans, and morphea guttata.

What is the next approach in the treatment of this challenging disease? Perhaps the refinement of certain previous approaches may be the answer. Perhaps the parenteral acid therapy so promisingly used in the case described here may be a solution. Yet where in one man's practice or in a single hospital or even in a single city will sufficient cases be found on which to demonstrate this new therapy and to determine its soundness?

Time alone will bring the dependable treatment; time and good fortune.

[Reprints of this article, with the complete bibliography of the literature of the world on this subject, will be available as noted on the Contents page.]

Industrial Medical Practice

—*Some Essentials*—

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INDUSTRIAL MEDICINE comprehends: (1) A study of physical fitness in respect to employment; (2) A study of the working environment; (3) The diagnosis and treatment of injuries sustained at work; (4) The diagnosis and treatment of occupational diseases; (5) The diagnosis and treatment of personal illness occurring while at work; (6) Treatment of minor medical and surgical ills; (7) Evaluation of disability in relation to retirement.

These seven assignments constitute the major responsibilities of every physician who makes industrial medicine his specialty.

Physical fitness and working environment are closely related. It is folly to try to apply the same physical standards to all types of work. The ideal office worker obviously has different physical characteristics and mental attributes from the shop worker. He is apt to be more slender in stature and to possess a higher I. Q.; he is subject to somewhat different physical and nervous ills from those of his shop brother.

In a very similar way various types of shop work call for a variety of physical statures, personalities, and intelligence quotients. The big boss usually excels in personality, the technical man in I. Q., the foundry worker in physical stature. Some jobs call for the long, lanky, wiry type; others for a more sturdy gorilla build. The trained employment man instinctively knows all this and usually makes a good selection, but the examining physician must be ready to challenge his judgment.

The physician's real job is to recognize significant physical conditions that could prove a source of expense or embarrassment to the employer, and then temper with judgment his recommendations for accepting or rejecting the physically-handicapped worker after due consideration has been accorded his ability, his personality, and his character as known through previous service. It becomes apparent at once that two classes of applicant are entertained for employment; those with previous substantial service and those without service. One controversial point is: "What constitutes a substantial service?"

A fairly well defined schedule governs our rejections of the physically handicapped. We have some latitude in the case of old employees. Should there be more latitude when dealing with new ones? Have we leaned backward in our desire to eliminate risks? Compensation laws are being broadened constantly, and are administered more and more in favor of the worker. As long as the labor market will supply workers who are not physically handicapped, should any who are so handicapped be accepted? One large corporation makes no special effort to detect incipient tuberculosis when girls are employed, but extends liberal financial aid to those found suffering with the disease at a later date. This attitude is said to be based upon a social conscience. They feel an obligation to absorb their share of society's physically handicapped. Does or should a large corporation have a social conscience or obligation beyond its own family of employees? The Federal government sets a poor example. No worker can be accepted on P.W.A. who is known to suffer from heart disease in any form, regardless of the job under consideration. Yet, for all that, I believe it should be our aim to absorb some of the reasonable risks, provided the physical handicap is correctable or curable while at work, and provided the applicant is known to be "not accident prone." We all know many physically-handicapped workers who rarely, if ever, come to the hospital, while many physically-perfect specimens occupy our time with repeated accidents. They are the accident prone. They are the 30% of workers who give us 85% of our work. They deserve much more careful scrutiny than the physically handicapped.

Accident proneness does not start when a man is given a factory job. It is a definite inherited characteristic, like blondness or big feet, and is seen all through childhood and youth. One hears the expression: "Poor fellow, he has such hard luck, always getting hurt." It is well and good to sympathize with such a person, but beware lest you shall be responsible for his acceptance in the shop. The employment man should know his history; the physician should note physical evidence of previous accidents. If the applicant passes through these two front line defenses, the boss should spot his shop attitude before it is too late.

We plead, then, for a somewhat more liberal attitude toward prospective workers who have corrective physical defects or curable diseases and a much more drastic policy toward the accident prone.

One other class of employees deserves our careful attention, the nervously weak and the emotionally unstable. It has been variously estimated that 20 to 30% of the working population can be so designated. They are the highly imaginative, over sensitive, and introspective group whose emotional life either soars aloft or dives deeply. When placed in a suitable environment these people make excellent workmen, but tend to work too hard in spurts, and then require a breathing spell for renewed energy. They are not well suited for repitition work, and when injured they need very special consideration. They are the first to listen to radical leaders, prevalent in such groups. Like epileptics, the small percentage of true psychopaths among the emotionally unstable should be dismissed from employment or, better still, discovered before hiring.

WE HAVE dwelt too long perhaps on interesting employment side lights. Without attempting to analyze the infinitely varying shop environment, I wish to remind you that standards of a generation ago are not acceptable today, any

more than those of today will be acceptable tomorrow. We have done our best to safeguard occupational hazards. Lead dusts, mercury vapors, benzol fumes, chrome mists and fine silica particles have been pretty well disposed of through ventilation. We promote the slogan, "Better Light, Better Sight." Dangerous machinery has been safeguarded, skin protection is afforded where needed. The safety shoe and goggle program has reaped a big reward. Already shop accidents constitute but a small percentage of those sustained in the home, through recreation, and on the highway. Occupational diseases are insignificant compared to the other diseases causing loss of time from work.

But it requires only a tour of shop inspection to appreciate that much more is needed to make the working environment not only a safe but also a happy one. There are noises, noises, everywhere — rasping air hoses and pounding machinery; noises that can be eliminated, and some that can not. It has been demonstrated, recently, that the Maxim silencer principle will completely squelch the rasping high-pitched sound of air exhausts. There must be a better way of drying small parts than by blasting them with a stream of compressed air. Notoriously noisy jobs can and should be isolated, ear protection being afforded those workers necessarily exposed.

We see men eating on the job from 9:00 o'clock on throughout the morning. Many come to work on an empty stomach. Haggart has proved conclusively that physical efficiency is enhanced 10 to 15% if five meals are eaten each day instead of three — even though the daily caloric intake is the same. More frequent rises in the blood sugar seem to be the secret of this discovery. The possible practical application of this principle, at least to workers doing repetition work, should be carefully considered.

Time doesn't permit further elucidation of other phases of factory life. The guide to the future should be to make the working environment not only safe but also cheerful and happy, and to apply the principle of preventive medicine versus curative medicine.

Yet curative medicine and surgery are, and probably always will be, with us. Extenuating circumstances make for unavoidable accidents. Every accident is potentially a serious one. We tend to make over-much of lost time accidents and pass over the more frequent ones in a lighter vein when only "Lady Luck" so often separates the two.

WE ARE devoting considerable time on this program to the diagnosis and treatment of industrial accidents. At this time I wish to stress one point: *Diagnose and treat the injured workman in a comprehensive, understanding manner.* We may differ from his point of view on causal relation, we may feel unsympathetic toward the manner in which he was hurt, we may be sick of seeing his face around the dispensary, but very often if we devote a little extra time and attention toward getting his view point, we will change a "sour puss" disgruntled worker into a loyal one with an "esprit de corp."

Every shop presents a different picture in respect to occupational hazards, and if they remained the same it would be relatively easy to cope with them. But they necessarily change with newer and better methods. So often a new method is tried with but one thought: "Will it fill the bill?" The introduction of a serious health problem is overlooked. It is absolutely essential that the plant physician serve on the committee scrutinizing the introduction of new methods of manufacture involving the use of toxic materials; and the plant physician, in turn, must carry out a well-regulated program to observe the effects of various materials on the workmen exposed. The job really involves prognosticating the safety factor, then clinical and laboratory checks as a Q.E.D.

The search for possible toxic effects of materials used gives a good entré to discover whether workmen are happy on the job and if not, why not. It will also bring to light incidental physical defects that can often be corrected in their early stages. Workmen must be taught to understand that simply because they may be exposed to safe limits of a potentially toxic material, all their ills do not arise therefrom. Some prove quite unreasonable in this respect.

The industrial hospital becomes a diagnostic clinic for a great many workmen who become sick for any reason while at work. These illnesses comprehend most of Sir. Wm. Osler's book of medicine. Respiratory infections, acute exanthemata, acute digestive disorders, kidney stones, tachycardias, coronary thrombosis, pneumonia, and cerebral vascular accidents are some of the common ones. A diagnosis should be made, if possible, the sick workman sent home or to the hospital in safety, and his family doctor and shop foreman notified. In handling these details special effort should be made to please everyone concerned, especially the patient.

Many workmen seek help for personal illness from the physician in industry. Except where company policy is otherwise, there should be a definite line of demarkation for guiding the physician. His efforts should not conflict with family medical practice. It seems proper to help in the treatment of minor medical and surgical ills and to use existing laboratory facilities or instruments of precision in helping to make a diagnosis when requested by the family physician or dentist. Under no circumstances should the industrial physician attempt to play family doctor for two or three thousand people.

With the Federal and State governments taking such an active interest in the proposition of improving medical care for the indigent and low-salaried employees, one wonders whether an elaboration or modification of Consolidated Edison Company's plan may not be the best answer.

The infirmities of old age come to every man not because of but in spite of his work. Unfortunately some age prematurely, others acquire some sys-

temic disease that is incompatible with work. The industrial physician must evaluate carefully the worker's disability and declare total and permanent disability for all types of work. In the past we have seen too many cases of advanced tuberculosis and neuro or cardiovascular syphilis. Heart disease on a coronary basis takes the greatest toll, yet quite a few coronary cases can carry on safely if special provisions are made. A clever diagnosis such as an abnormal metabolic rate may be the basis for extending a worker's usefulness many years.

Having determined the question of disability, we should specify the need for extra medical attention and prognosticate the life expectancy. An accurate diagnosis, backed by data from instruments of precision, will help in making these statements.

WE HAVE tried to sketch, briefly, some of the salient features of industrial medical practice. Controversial points have been raised. I trust their presentation will persuade to thought about the correct answers.

The industrial physician has a much greater variety of problems to solve than has any other specialist, for he must be internist, surgeon, orthopedist, toxicologist, radiologist, dermatologist, psychiatrist and sociologist all at once. Dr. Johnstone, of California, in his recent address to a body of leading internists said: "Industrial medicine needs not only guidance but more abundant recognition as one of the important medical specialties."

Chronic Systemic Diseases

—In Industrial Workers: Public Health and Compensation Aspects—

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THE subject of chronic systemic disease among workmen is only one aspect, but an important one, of an industrial hygiene program. As we review other phases of our past and present activities respecting such a program, we would note that our group has cooperated in the accident prevention program; care of injuries is a fairly well standardized part of our daily job; the recognition and prevention of occupational disease hazards has been emphasized, and continues to be an active subject; pre-employment examinations have become more complete and thorough after mutual discussion, and results from this effort have been fruitful; and, finally, we have made a start in the matter of periodical physical examinations of certain groups.

The detection of chronic systemic diseases in workmen is probably a less dramatic phase of the program, but a most important one for several reasons:

1. It is an important phase of preventive medicine, and certainly we should carry preventive medicine into industry.

2. Mortality rates are higher in industrial populations than in the group of gainfully employed persons as a whole.

3. Studies of illness in industry made by the U. S. Public Health Service show high rates.

4. The causes of death in advanced years are primarily chronic, and the proportion of our employees in advanced age groups is constantly increasing (a recent survey showed that 51.5% of our hourly rated employees were 40 years of age and above).

5. Statistics show that the average person has 10 days per year incapacity from illness and accidents — six of the 10 are due to chronic diseases including permanent impairments.[1]

6. Studies made by the American College of Surgeons indicate that illness causes 15 times as much absenteeism as industrial injuries. (I wonder if we have given this phase a proportionate amount of attention?)

For this discussion I have selected the following diseases and conditions as representative, if not all-inclusive, of those chronic conditions which have important public health aspects and at least potential compensation aspects:

1. Venereal diseases.
2. Chronic focal infections.
3. Chronic diseases of middle and late life:
   (a) Cancer.
   (b) Diabetes.
   (c) Diseases of the heart, blood vessels and kidneys.
   (d) Arthritis and rheumatoid disorders.
4. Tuberculosis.
5. Chronic non-specific ill-health.

We have no figures to show the incidence of these diseases in our own plant. We have available, however, statistics on a national scale. The following general facts regarding the above diseases have been recently advanced by the Interdepartmental Committee to Coordinate Health and Welfare Activities:[2]

VENEREAL DISEASES:[2] Syphilis, aside from being a specific cause of death in itself, contributes about 50,000 deaths annually through involvement of heart, blood vessels and nervous system. Ten per cent of first admissions to mental hospitals are attributed to syphilis in its late stage manifested as general paralysis. If, as has been estimated, only one-third of the syphilitics requiring treatment at a given time are now under treatment, then it would appear that our program along this line should continue if we are to find the new cases coming into our plants and maintain a treatment follow-up of those already discovered.

CHRONIC FOCAL INFECTIONS: The role of focal infection in chronic systemic diseases has run the gamut of all shades of positive and negative opinion. Bierring,[3] in his recent Billings lecture, surveys the last quarter century thought on this subject and summarizes the fairly well established facts of today, such as: the relation of oral sepsis to conditions elsewhere in the body; the frequent occurrence of myositic pain in tonsillitis; peripheral neuritis associated with various local in-

fective foci; the relation to certain ocular diseases, of chronic focal sepsis in the intestinal tract, gallbladder, accessory sinuses, prostatic urethra, and the pelvic organs in the female. In the field of dermatology, certain cutaneous disorders may act as foci of systemic infection, and vice versa, focal infection elsewhere may initiate certain skin disorders. He points out the frequency with which the onset of sub-acute bacterial endocarditis is preceded by upper respiratory infections, genitourinary tract infections, and sometimes wound infections. The frequency of pyorrhea and dental abscesses in the early history of pernicious anemia is cited by Murphy. Focal infection has long been associated with arthritis, and is generally conceded to be *one* of the many initiating and contributing factors. Bierring concludes his survey with the statement that "the efforts that have been proposed to detect and then to obliterate all forms of focal infection in the mouth and throat as well as elsewhere in the body for preventive as well as for curative purposes, besides being in accord with sound reasoning from general principles, have received the support of strong experimental evidence."

I think we are justified in saying that chronic focal infections in our industrial population are no small factor in contributing to absenteeism and lowered health levels and are not infrequently complicating factors in recovery from injuries.

CHRONIC DISEASES OF MIDDLE AND LATER LIFE:

1. Cancer:[2] Estimates place the number of living persons with cancer today at 400,000. It is responsible for 10% of all deaths. At the present mortality rate, it is probable that one person out of every eight who reaches the age of 45 will ultimately die of cancer.

2. Diabetes:[2] There are an estimated 400,000 to 500,000 diabetics in the United States today. It has been demonstrated that the mortality for every age can be reduced, by early detection and adequate treatment.

3. Diseases of heart, blood vessels and kidneys: Medical science has done little to affect the mortality rates in this group of diseases, except indirectly to contribute to an increase by saving more babies and youths to attain the status of advanced age. Heart disease as a cause of death has been increasing in frequency for many years. Essential hypertension is important because of its ultimate effects on heart, brain and kidneys; from 60% to 70% of persons with this condition eventually develop myocardial insufficiency and die of cardiac failure; about 20% die of cerebral accidents, and about 10% of kidney complications. This combined group of diseases is responsible for about 40% of all deaths.

4. Tuberculosis:[2] "There is evidence to show that tuberculous deaths can be reduced 50% by health supervision of workers in occupations predisposing to the disease, by detection of incipient cases and adequate medical care in the early stages. While the 1938 mortality figures indicate a downward trend (the current rate being 10% less than in 1937), tuberculosis is by no means a conquered disease. It is possible that the rate for 1938 will drop below 50 per 100,000 for the first time."[5]

5. Arthritis and rheumatoid disorders: While diseases of this group rarely result in death, they are responsible for an enormous amount of suffering and disability. It is estimated[2] that 1½ million persons are disabled annually by arthritis; another 1¾ millions by neuralgia, neuritis and lumbago. Since the etiology in this group is so varied and manifold, and as yet not completely solved, no single specific cure or method of attack has been evolved.

CHRONIC NON-SPECIFIC ILL HEALTH: I have added this group merely to include some conditions which cannot be included in any of the foregoing groups; it is a varied and indefinite group. But I am sure we all see cases that are chronically tired, continuously under par, with low vitality and lack of sustained effort. Many of them are difficult of analysis; definite physical findings are often lacking. The factors active in these cases seem to include such items as constitutional inferiority or inadequate inheritance, chronic fatigue, faulty health habits, physical and mental excesses, overweight and underweight, general wear and tear of the strain of excessive living, etc. Some are probably of glandular origin. The home office of the Aetna Life Insurance Company[6] has demonstrated what can be done in such a group of employees by a program of physical fitness examinations, health diagnosis and correction of physical defects and faulty health habits (diet, exercise, weight control, worry, recreation, etc.). The net result was an average reduction of 46% in days off from sickness. I inject this group here chiefly as food for thought.

The most comprehensive picture of the public health aspect of these chronic diseases can best be presented by a summary of mortality and morbidity trends for the general population and for large industrial groups. These statistics have been compiled from U. S. Public Health reports:

FREQUENCY OF DISABILITY LASTING EIGHT DAYS OR LONGER
MALE MORBIDITY EXPERIENCE OF INDUSTRIAL COMPANIES
REPORTING CASES TO U.S.P.H.S.

DISEASES AND DISEASE GROUPS WHICH CAUSED DISABILITY	ANNUAL NUMBER OF DISABILITIES PER 1000 MEN IN		
	First Nine Months of		
	1937	1936	5 years 1932-1936
Sickness	92.8	80.5	76.7
TB of Resp. System	.8	.8	.9
Rheumatic Group, total	9.3	10.1	10.0
1. Rheumatism, acute and chronic.			
2. Diseases of organs of locomotion.			
3. Neuralgia, Neuritis, Sciataca.			
Diseases of Heart and Arteries, and Nephritis	4.0	3.8	3.9
Ave. No. of males covered in record	183,748	153,780	145,070
Number of Companies	26	26	.....

MORTALITY RATES FOR 1937 AND PROVISIONAL MORTALITY RATES FOR FIRST HALF OF 1938
(U.S.P.H. REPORTS—MAY, 1938, AND OCTOBER, 1938)

SOURCE AND PERIOD	All causes rate per 1000 pop. (annual basis)	DEATH RATE PER 100,000 POPULATION (ANNUAL BASIS)						
		Tuberculosis (all forms)	Cancer (all forms)	Diabetes	Cerebral Hem.—Apoplexy	Diseases of Heart	Nephritis	Combined % of total death rate (6 causes)
Year 1937. 41 States. Estimated Population 7-1-37—109,846,000..	10.9	49.6	112.1	24.2	85.4	263.4	78.3	56%
Jan.-June 1938—39 States. Estimated Population 105,575,000....	10.8	48.8	112.4	24.8	86.5	272.4	80.9	58%
Ave. 5 yrs. '33-'37 Incl.....	10.9	52.2	108.9	23.1	84.8	247.1	81.7	
Metropolitan Life Ins. Co., (Ind. policy holders, age 1 yr. and over). Jan.-June, 1938. Provisional rates 17,700,000 persons.....	8.1	49.0	96.1	26.2	61.2	162.4[1]	56.1[2]	55.6

1. Excludes pericarditis; acute endocarditis, acute myocarditis, coronary artery disease and angina pectoris.
2. Chronic nephritis (Bright's disease only).

COMPARISON OF MEN AND WOMEN (ILLNESS RATES)[7]

Cause of Disability	Annual cases per 1000		% of men's rate
	Women	Men	
Sickness.....	134.3	77.3	174.
Tuberculosis.....	1.4	1.0	140.
Bronchitis.....	7.3	3.6	203.
Influenza.....	28.0	15.8	177.
Nervous diseases.....	6.9	1.1	627.
Skin diseases.....	3.4	3.0	113.

Unless and until we keep mortality and morbidity records in our organization, we have no way of knowing where we stand in comparison with the general picture or with similar occupational groups. The tabulation of sickness rates and absenteeism in industrial groups is being strongly recommended by national industrial hygiene authorities. We keep accurate statistics on industrial injuries and they serve as a measuring stick of progress—for the industry as a whole. Isn't it fully as important to chart our sickness rate, which causes perhaps 15 times as much absenteeism as industrial injuries? The following significant statement appears in every issue of the U. S. Public Health Reports: "No Health Department, state or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring."

Compensation Aspect of Chronic Diseases

AS TO the compensation aspects of the chronic systemic diseases, we do not have such a definite picture. Obviously, none of these are occupational diseases under the strict definition of that term; yet most of them have potential compensation aspects in that they may be, and frequently are, considered to be initiated or accelerated by industrial conditions. Our own compensation experience with these diseases as factors has been practically nil, with the exception of syphilis and tuberculosis and even these have been very infrequent. Yet we know that they are frequent factors in compensation cases in many states, and the trends in social legislation and compensation laws will no doubt make these diseases more and more important. Sayers[8] has recently published some figures on the trend of compensation costs in Wisconsin, where a workmen's compensation law has been in effect longer than in any other state. In 1935, for example, "compensation cases settled represented a loss of over two million working days, and of these days lost 8% were accounted for by occupational diseases." "In other words," he says, "although the incidence and costs of occupational diseases are rising, occupational diseases account for but a small percentage of the total compensation cases and costs in the State of Wisconsin. Reports from other States, for example New York, New Jersey, and Ohio show a similar trend. According to the U. S. Department of Labor, the total direct and indirect costs of industrial injuries in this country are approximately five billion dollars annually, and of this amount but a small percentage is accounted for by occupational diseases." We can only conclude from this that non-occupational diseases contribute heavily to compensation costs in some States, and this will no doubt be true in most States in the future.

It would be impossible to discuss the compensation aspects of each of these disease groups. Because it is probably the most important in the list, I have selected pulmonary tuberculosis for a more detailed discussion both from the public health and compensation aspects. "It is," as Vosburgh[9] has stated, "perhaps the most important single disease factor in industry, since it takes its toll during man's most productive period." Forty thousand adults between the ages of 15 and 45 die annually of this disease—this represents 57% of all deaths from this cause. From an industrial standpoint, it is well known that as we descend the economic scale, the tuberculosis death rate increases; but this statement applies to other diseases as well, as shown by the following statistics:

DEATH RATES BY OCCUPATION

Occupation	All causes	Pulmonary TB	Pneumonia	Cancer
Professional men.....	670.5	26.2	38.8	70.3
Skilled workers.....	828.9	72.1	59.7	85.4
Semi-skilled.....	1009.3	102.1	71.6	90.8
Unskilled.....	1447.7	184.9	135.9	106.6

* Rates per 100,000 occupied males, based on U. S. census data in 10 selected states.

Not all this increase in rates in the lower income brackets is attributable to occupation. As early as 1915 a comprehensive industrial survey and analysis of predisposing factors in tuberculosis was made in Cincinnati;[10] this study embraced 38 different industries with some 20,000 employees. In 220 cases of pulmonary tuberculosis in this group, the following etiological factors were listed:

History of tuberculosis in family	34.3%
Poverty and poor housing most in evidence	10.5%
Alcoholism, venereal disease and excesses	7.2%
Other diseases and injuries noted	5.5%
Occupational hazards or working conditions	19.3%
None of the above factors in special evidence	23.2%
(complete data on 181 cases)	

Comparative death rates for men and women show that, from 15 to 30 years, there is quite an excess of deaths in women; from 30 years on, the higher rate is in the male group. Published statistics show the high proportion of tuberculous deaths to total deaths in such occupations as pottery industries, brass workers, glass workers, hat and cap makers, marble and stone cutters, tobacco operatives, tool and cutlery makers and others, in most of which dust is the outstanding industrial hazard. It is well known that tuberculosis frequently complicates pneumoconiosis and silicosis. Whitney[11] advances a method for estimating the incidence of clinical tuberculosis in industry. Thus, in 100,000 males gainfully occupied in selected industries, ages 15 to 64, the tuberculosis mortality is 87.5. Multiplying this number by 5 gives the estimated number of active clinical cases in this group. The factor 5, as adopted by the Administrative Practice Committee of the American Public Health Association, assumes a total of five cases of clinical tuberculosis on a given day in a community to each death occurring during the year. Ornstein[12] reminds us that it is important to divide the incidence of tuberculosis into clinical incidence and x-ray incidence; for example, in a group of 2200, the incidence of clinical tuberculosis was 2.7%—of x-ray tuberculosis 11.1%

I recently heard Block, of Chicago, in a public address state that, based on a large group examination by x-ray, 1.5% of the population of the U. S. is walking about with clinically important tuberculosis. If this is true, then we all no doubt have undiscovered cases of clinically important tuberculosis in our groups, unless we have deliberately gone out to find them. He emphasized also that cases that have so-called *early clinical symptoms* are not really the early cases—that our admonition to the laity to take notice of such symptoms as loss of weight, persistent cough, chronic tiredness, fever, etc., is really ineffective in spotting early cases. X-ray and re-x-ray of all *contact* cases is the answer for finding the really early cases without symptoms.

Compensation Aspect of Tuberculosis

OUR own experience with tuberculosis as a compensable disease has been very limited; but many cases have been, and are coming before Industrial Boards in every state. A monograph[13] published this year by the National Tuberculosis Association reviews the medical and legal aspects of this subject quite completely. The various attempts to define "occupational disease" are reviewed; four States (Conn., Ill., Ind., and R. I.) have defined it by statute. Six other States (Cal., Ohio, Me., Mo., Texas and Wash.) have had occupational disease defined by the courts in specific trial cases. "The definitions of all are similar in that they require that the disease must follow as a natural incident of the work and is usually conceded to have developed gradually over a period of time. However, there are a great many uncertainties connected with their interpretation when applied to tuberculosis, and the necessity for standards as to what amount of exposure constitutes a hazard is obvious." The various States have different types of legislation (schedule, general coverage, disease as injury, etc.) but even in those having similar types of legislation, there is a lack of uniformity in the interpretation of the laws. The greatest uniformity has been in awarding compensation to nurses and others "who proved to the courts that they had contracted the disease by exposure to tubercule bacilli through contact with tuberculous patients in the course of their employment." In non-contact cases there is no such uniformity; the general conclusion is made that "in the States that are legally unable to compensate for occupational disease, tuberculosis is called an occupational disease; where it *is* legally possible to compensate for the disease there is a tendency to consider tuberculosis unrelated to the occupation. Consequently the indefinite status of the disease in the laws causes confusion and lack of uniformity in the decisions of the courts and commissions. The recent decision in New York will help establish precedent regarding the status of tuberculosis as an occupational disease." (Case 44)

An effort has been made to establish medical standards for guidance of the courts in cases of trauma and tuberculosis, but here again there has been honest difference of opinion. Medical opinion is generally agreed that pulmonary tuberculosis may be properly considered as an occupational disease:

1. In those caring for the tuberculous sick.
2. In some occupations where there are contacts with a large number of people in whom there may be a high incidence of tuberculosis—as salespeople, waiters, etc.
3. In those continuously exposed to silica dust.

The remainder of the compensable or potentially compensable cases are either traumatic or non-traumatic. Of course, no trauma, direct or indirect can cause tuberculosis (except by direct implantation of bacilli); but there is general agreement that trauma can light up a dormant infection, or cause an already active case to progress more rapidly. The disagreement is chiefly in regard to the time element, that is, the period elapsing from the time of the trauma to the appearance of activation or progression of the disease. Some authorities believe that there should be *no* time limit because tuberculosis is a slowly developing disease; a six months' limit has been proposed by others. Ornstein,[11] on the contrary, insists that the time

interval should be short, that there is a manifest evidence of re-activation within 24 to 48 hours. He bases his argument on the Koch phenomenon, namely, that in humans previously infected by tubercle bacilli, any re-infection (implantation of bacilli in sensitized tissue) is manifested within 24 to 48 hours by changes in the lungs which can be visualized by the x-ray; that trauma can be an activating factor only by releasing bacilli from a quiescent focus, and that when these bacilli invade healthy (but sensitized) lung tissue, an immediate reaction is set up and reaches its maximum in 24 to 48 hours. Based on this reasoning, his formula for determining the causal relationship between tuberculosis and alleged injury is simple and concise: "X-ray all traumatic injuries immediately and at the end of the first or second week; if no changes are noted in this interval of time, it is logical to assume that the trauma has no causal connection with tuberculous disease which may develop at a later date." I do not know whether this opinion has stood the test of court procedure, but if it is a correct view (and it would seem to have a sound physiological basis), then it is something definite and tangible to offer as medical opinion in court cases, provided we have the required x-ray examinations. Certainly the admonition to x-ray all cases of chest trauma is good advice, if for no other reason than that it helps in finding tuberculosis in our employees, and in determining whether the disease was present and to what extent, at the time of an injury, for later comparison if trauma is alleged as a causal or aggravating factor.

As to non-traumatic causes of aggravation of pulmonary tuberculosis, various irritating gases and vapors are generally considered to be possible aggravating factors—ammonia, chlorine gas, brass fumes, hydrogen sulphide, concentrated acid fumes and sulphur dioxide are examples. Ornstein[11] believes the time element in such cases is the same as in the direct traumatic cases.

While tuberculosis is sometimes considered a true occupational disease, practically none of the other chronic diseases I have discussed (except cancer) could be construed as truly occupational; most of them, however, are subject to aggravation by injury and are, therefore, a source of potential compensation claims. This is especially true of syphilis, diabetes and heart disease.

Out of the above discussion what can we select as something tangible for use in furthering an industrial hygiene program? I think we can all agree that the detection of chronic defects and chronic systemic diseases will afford a major attack on the reduction of absenteeism due to illness. Just how we can accomplish this effectively and systematically has been the difficulty in the past. In my opinion the ideal answer is periodical physical examinations and the keeping of statistical records of absenteeism. Unless and until we attain *this* goal, we do have a few avenues of approach which yield some measure of good results, and have been the sources of case finding to date; they are, however, incomplete. Some of these are:

1. Our pre-employment and re-employment examinations. In periods of heavy hiring, this group is often quite large.
2. Certain occupational groups which are scheduled for periodical examination.
3. Examination of employees after absence from illness.
4. Examination of those coming in with physical complaints, minor illnesses, after accidents, etc. Of course, not all of these cases can be given complete examinations when reporting with such conditions, but we can often pick out those who appear to warrant more than casual treatment.
5. The group of key-men.
6. Encouragement, by education methods, of periodical examinations by the family physician. I am not convinced that the percentage of effectiveness of this method is very high. It has been my experience that few people report regularly for a periodical examination unless they are definitely notified to do so. The dentists are far ahead of us in making this plan work.

By the above contacts, we do have opportunity to check a part of our employees. Checking these groups for the year 1937, I find that we had:

2933 pre-employment examinations;

83 in occupational groups scheduled for periodical examination;

122 special examinations (voluntary, referred, pensioners, etc.). Total 3138 examinations.

The deficiency in this program is that some employees may be examined several times during the year (because of layoffs and re-hiring) and these are apt to be in the younger age groups; while we may miss entirely those with longer service, not subject to layoff—and these are most apt to be the group in which we shall find the diseases of middle and later life.

WE HAVE had some recent concrete examples of case finding of chronic conditions in some of the above groups, especially cases of pulmonary diseases. A few of these are summarized:

EXAMINATIONS AFTER LAYOFF:

1. E.B. (F), age 35, had been off about two months for lack of work; had had no examinations previous to layoff or during the past five years. The pre-employment examination, after recall, revealed both clinical and x-ray evidence of bilateral pulmonary tuberculosis.

2. T.M. (F), age 25, had been off about sever months for lack of work. During her layoff perioc she had noted some weight fluctuation, her family physician had carried her through a cervical lymph node abscess and with it she had considerable cough, but the chest had not been investigated; another physician was giving her "cold" vaccine at the time of her recall. X-ray showed bilateral pulmonary tuberculosis with cavitation on one side; disease clinically active.

3. C.C. (M), age 35, had been laid off two months. Routine fluoroscopy, checked by further x-ray study, showed a marked increase in hilar shadows, the process extending into the mid-zones. There were no subjective symptoms. At age 15 he

had had measles with a history of temporary chest complication; influenza in 1918. Family history was negative. No fever, sputum or cough. The type of infection is not yet established in this case, and it is apparently clinically quiescent; but discovery of the condition guided us in job placement and enabled follow-up examinations.

4. H.S. (F), age 21, recalled for work after nine months' layoff; history of upper respiratory infection four weeks previous to her recall—illness lasted about one and a half weeks, for which she had medical attention; about a year previous to this illness, she had had a period of shortness of breath and a right cervical lymph node enlargement; lost 14 lbs. in weight this past summer (during layoff period). Routine fluoroscopy showed extensive pleural effusion at right base. Patient had considered herself recovered at time of pre-employment examination.

EXAMINATION AFTER ILLNESS:

1. E.K. (F), age 21, off work seven weeks because of influenza and pleurisy (physician's diagnosis). She had been released by her physician to return to work. Weight was 20 lbs. under standard.

The examination showed bilateral pulmonary tuberculosis, clinically active; there was some difficulty in persuading both the patient and her physician that she could not return to work; subsequent course has been downward.

CASES ON ACTIVE PAYROLL:

1. J.H. (M), age 43, 12½ years of service; has worked steadily without absence due to illness; came to the dispensary because of a profuse rhinitis and a productive cough for the past couple of months.

The routine examination (including x-ray) showed a chronic fibrous tuberculous lesion of the left apex. Sputum examinations negative. He gave a history of a rather prolonged chest infection in 1910 and of being "gassed" during the World War. While this case is inactive and not a present menace to fellow employees, discovery of the condition will serve as a guide to future placement.

2. H.B. (M), age 27, office employee; vague symptoms had been passed over by several physicians; his last attending physician suspected tuberculosis and referred him to us for chest x-ray; diagnosis; active pulmonary tuberculous lesion with cavitation.

3. C.F. (F), age 27, sweetheart of the above case. Is under observation as a contact case; has a questionable lesion (early, if any) in extreme right apex; positive Mantoux test; this is an example of a contact case in industry that can be kept under close observation with serial x-ray studies, with the object of preventing such advanced and destructive lesions as have occurred in most of the cases previously cited.

Every industrial physician can, no doubt, duplicate these cases, not only in the matter of tuberculosis but in other chronic diseases as well. The common denominator in most of these cases is that their diseases *were* chronic and could have been detected much earlier if they had had adequate examinations in time.

Summary and Conclusions

WE HAVE tried to emphasize the trend to carry preventive medicine into industrial medical practice.

2. The detection and treatment of chronic systemic diseases is an important phase of an industrial hygiene program for several reasons:

(a) It should increase the health and efficiency of employees in this group.

(b) It should favorably affect mortality rates and reduce absenteeism.

(c) Any improvement in the general health of an industrial population is reflected in the health of the community.

3. A review of court decisions and of statistics of some States indicates that occupational diseases account for but a small per cent of the total compensation cases and costs. The remaining costs could no doubt be lowered by a broad attack on the problem of chronic diseases in the industrial population.

4. Pulmonary tuberculosis is an outstanding example of this group of chronic diseases and deserves special attention, both for its public health and compensation aspects.

5. Physical examination of employees is the backbone of a program of preventive medicine in industry.

6. Complete records of absenteeism would give much illuminating information for points of attack, for purposes of comparison with the experience of our industry as a whole, and as a yardstick of progress in reduction of absenteeism.

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Syphilis in Railroad Medicine

—A General Consideration of the Problem—

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THE recent renewal of interest in an age-old disease that has taken countless lives and caused untold suffering, is manifested by innumerable articles in both lay and medical journals.* Their overwhelming inundation of facts, figures, fancies and philosophical outbursts leaves me with the feeling that anything I might add would appear trite and boring.

However, this disease by weight of its prevalence pokes its ugly head into the consciousness of those who by force of circumstances are relegated to its handling, and makes reiteration a means to emphasize its seriousness as a national affliction. This scourge which the public health authorities are mobilizing to fight and conquer is as much a problem of railroad medicine as it is of all other branches.

As Dr. Stokes has written: "Syphilis is, in an as yet not clearly defined proportion of cases, a reducer of efficiency and a producer of hazard and disability in life, in industry and in the social order at large. The person who has a syphilitic infection may fail his family at the critical juncture of its life history; he may fail his fellow workers in an executive post; he may fail the public at the head of a fast moving train."

Syphilis is a disease of antiquity, in all possibility originating on our fair shores, for Aschoff recently has reiterated and strengthened the suspicions of the early Grandees of Spain that Columbus' sailors derived no health benefits from their extended sea voyage. Sehaudinn discovered the causative factor in 1905. The complement fixation test was presented in 1907 through the researches of Bordet and Wassermann. Erlich ended his 606th experiment in 1910. Since then many brilliant contributions to the scientific knowledge of clinical, pathological and public health aspects of syphilis have appeared.

It is not odd, in view of the antiquity of these facts, to find it necessary to point out how little attention has been paid to the control and eradication of syphilis in the past 30 years, except for the period of mobilization of the spirochete in the years of 1917 and 1918, and the recent public health campaign.

In all industrial hospitals a man may be honorably handled, capably diagnosed, and treated for a broken leg, typhus fever or tuberculosis, but not in all instances for syphilis. Here a moral and even financial issue arises which makes the sufferer responsible for having acquired the disease, however acquired, and in spite of the fact that he is a hazard and a potential financial loss to his fellow workers and his employer, he is allowed to go unrecognized. Moreover, if a man enters a hospital in which serological tests are compulsory the diagnosis of syphilis may be made, but even then in many instances his treatment is haphazard and relegated to men having little or no appreciation of the problem.

IT WOULD appear to me that industrial medicine and especially railroad hospital services should take an active interest in this subject from the various standpoints of prevention, identification and medication. The cost of such an activity would, I am sure, be offset by the efficiency maintained, fewer patients admitted to the hospital and a host of other reasons, not the least of which would be the preservation of the good will of the employees. It is needless for me to point out that on the whole railroad workers belong to an intelligent, clear-thinking group, with a practical outlook on life.

The necessity of such action becomes more apparent when one considers the anticipated crop of syphilitics for the ensuing year in the United States. Three million would be a conservative estimate, with approximately 650,000 new cases. Obviously the government cannot cope with such a problem without the help of all physicians, and particularly the help of industrial medicine. This latter branch of medicine reaches a group of worthy people neither helped by national government agencies nor syphilitic clinics maintained by states, counties and cities.

By the foregoing I do not mean that no attempts have been made to reach the latent and active syphilitics in industrial medicine, for many important reports are found in the literature of surveys made which furnish serological evidence of the enormous amount of latent syphilis. These figures vary all the way from 1.1% to 13%. One point to note is the high percentage of serological positivity in the employed as contrasted with the lower percentage in applicants for employment where acceptance is predicated on a negative serology.

ABOUT six years ago, Dr. W. A. Morrison, Chief Surgeon of the Santa Fe Coast Lines, ordered blood tests for syphilis to be performed on all employees admitted to the Santa Fe Coast Lines Hospital. This service was also extended to private patients, relatives in most instances of the employees, and all industrial accident cases. For the past six years some 18,000 bloods have been examined, over 1,800 patients were determined to have syphilis, a yearly incidence that varied from 10.2 to 11%. Later attempts were made to perform serological tests on all applicants for service, and a positive serology was included in a list of physical disabilities as grounds for rejection. Obviously moral or humane issues have not and cannot be considered in this group, for reasons that are quite apparent. Furthermore, I doubt if this phase of encroachment in the domain of public health control is justifiable from the standpoint of the employees who support and maintain railroad hospitals and medical services.

* From Santa Fe Coast Lines Hospital, Los Angeles, California. Presented at the Fiftieth Annual Meeting of the American Association of Railway Surgeons, Chicago, September, 1939.

TABLE I.
A REPORT OF THE WASSERMANN AND KAHN TESTS
SANTA FE COAST LINES HOSPITAL

	1936-1937	1938	1939 (to Aug. 15)
Total number of tests performed	5651	3295	1817
Positive tests	621—10.9%	343—10.4%	174— 9.5%
(a) White people	4745	2816	1464
Positive tests	399— 8.4%	227— 8.0%	118— 8.0%
(b) Mexicans	906	479	344
Positive tests	222—24.5%	116—24.7%	49—14.2%
Applicants for employment tested	1273	762	634
Positive tests	135—10.6%	56— 7.3%	38— 5.9%
(a) White people	987	484	455
Positive tests	55— 5.5%	21— 4.3%	17— 3.7%
(b) Mexicans	286	276	177
Positive tests	80—26.9%	35—12.6%	19—10.7%

THE figures of Table I show an incidence of serological syphilis in excess of the report of Chicago's 1938 dragnet survey, in which 4200 positive diagnostic serologies per 100,000 tests were given.

It is to be pointed out, however, that at least three-fourths of the tests that I have reported were performed on hospital patients confined for illnesses or accidents. Does this infer that a syphilitic is more liable to suffer injuries or illnesses? Undoubtedly it is an interesting thought. However, I do feel certain, notwithstanding the importance of such a procedure, that if we perform serological tests on all employees a much lower incidence of positive serology will be found.

It is inevitable that serological incidence of the prevalence of syphilis will reflect the problems of false laboratory reports both positive and negative. With this in mind, I offer the following figures based on autopsies performed at the Santa Fe Coast Lines Hospital. I might add that our autopsy percentage is approximately 70% exclusive of coroner's cases. The number of autopsies is small, but the findings are interesting if not significant.

TABLE II.
INCIDENCE OF SYPHILIS IN POSTMORTEM EXAMINATIONS
SANTA FE COAST LINES HOSPITAL
1932 — 1939

	Number Autopsied	Syphilis	Percentage
White Americans	266	11	4.1
Mexicans	40	11	27.5
Negroes	8	3	37.5
Total	314	25	7.9

Positive serology and syphilitic lesions	25
Syphilis of aorta	20
Central nervous system lues	4
Hepar lobatum syphiliticum	1
Treatment cases without lesions	3

The figures of the incidence of anatomical syphilis at the Santa Fe Coast Lines Hospital are important and become more significant in the light of our work at the Los Angeles County Hospital. In the past four years or more we have performed 10,000 autopsies at this latter institution. The incidence of syphilitic lesions was as follows:

207 cases of luetic aortitis with and without aneurysms.
62 cases of meningovascular lues.
24 cases of tabes dorsalis.
10 cases of paresis.
29 cases of hepar lobatum syphiliticum.
2 cases of luetic proctitis.
7 cases of luetic skin lesions.
1 case of gumma of the extremities.
2 cases of gummata of the spleen.
38 cases of congenital lues.

387 Total — 3.87%.

These figures include neither those cases with positive serology without anatomical evidence of syphilis, nor minimal or healed lesions of syphilis.

I quite realize, and you must, that there is a certain amount of the artificial in the selection of these figures which cannot manifest an accurate estimation of syphilis in the entire population. However, it is apparent that there is a problem and that we have a job to do.

FROM the laboratory standpoint there are many problems to be solved. Allow me to backtrack a bit in the history of the development of blood tests for syphilis. Wassermann, Neisser, Bruck and Schucht applied the Bordet complement fixation tests in the diagnosis of syphilis. Since then this test has been refined and varied in a thousand different ways. Soon after the development of the Wassermann tests, Michaelis in 1907 observed that precipitates formed when the aqueous extracts of syphilitic liver were added to syphilitic serum. This apparently was the first report of a precipitation test. Twelve or 13 years later the precipitation test was refined and presented under the names of the Sachs-Georgi and Kahn reactions. Since then a great many flocculation tests have been described, including such modifications as the Kline, Eagle, Meinicke, Hinton and others. I might add that modifications are still appearing. These differ chiefly in the physical condition of the tests, the physical state of the lipoid suspensions and the quantitative relationship of the reagents. Up until 1934 no rational attempts were made to standardize flocculation and complement fixation tests. Nearly all laboratory directors had their own or borrowed brain children, so modified that even the philandering fathers couldn't recognize their own offspring of misconception. A new low in sensitivity must have been reached about the time the

American Society of Clinical Pathology requested the Surgeon-General of the American Public Health service to appoint a National Committee to evaluate serodiagnostic tests for syphilis. The results of this and subsequent serological evaluations brought to light certain startling facts that are known to most of you and are too numerous to give in the allotted time. Suffice it to say that in many instances the laboratory work was much inferior to what it should be. Further it is intimated that laboratory directors and assistants who refuse to weigh and check their abilities are of little value in the campaign against syphilis.

The role of the laboratory of the railroad hospital in the campaign against syphilis is mainly defined by inference in this paper. I have not touched upon the subjects of false positives and negative serological tests, the choice of test or tests, and other laboratory problems that concern mainly the laboratory directors and assistants.

IN CLOSING I would urge that all railroad medical services seriously consider the adoption of the following suggestions or similar suggestions modified by local needs, to the end that syphilis be controlled in the railroad personnel:

1. That routine blood tests be performed on all employees.
2. That blood tests be done yearly on all employees in responsible positions.
3. That all applicants for service have blood tests, included as a part of their physical examination.
4. That a vigorous educational campaign be carried on in the railroad personnel with special attention paid to the field of prophylaxis.
5. That adequate and follow-up treatment be furnished all syphilitic employees.
6. That a board of clinical men interested in the diagnosis and treatment of syphilis be appointed to work in conjunction with the laboratory director to handle all problems arising in the detection and treatment of railroad syphilitics.

It has been said that "the first obligation of a modern health campaign is to detect infection." This is our first duty, and without an unrelentingly critical attitude of our abilities in our laboratories and clinics, such detection will fall far short of the desired goal.

Current Comment

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—*Evaluation of the Industrial Hygiene Problem of Illinois*—

THIS study* was conducted in order to familiarize the Division of Industrial Hygiene with the health problems to which employees in the industries of Illinois are exposed and for the purpose of appraising the existing efforts at solving or avoiding these problems. Collecting these data was deemed necessary to the formation of a public health program commensurate with the needs in the industrial field in Illinois.

The information gathered, secured by visual methods, concerns itself chiefly with the conditions of environment. The data cannot be interpreted to indicate the extent or multitude of conditions inimical to industrial hygiene. They do not imply that the conditions now existing are unhealthful. Their summary in the published form is only a statistical compilation of the findings of the survey, essentially useful as a basis for promulgating a permanent program.

The Division was established in July, 1936, and made possible through Social Security Funds. The personnel was selected according to qualifications and standards formulated by the Conference of State and Provisional Health Authorities of North America.

Illinois ranks as the third largest industrial state in the country and the largest in the midwest area. "The 1930 U. S. Census figures revealed that 3,184,684 persons were at that time gainfully employed, of whom 1,147,379 were in industries in which the environments presented the greater potential hazards to health" (the basis of selection, however, is not clear). The plan of representative sampling of the important industrial group was followed.

Necessarily, occupational afflictions and industrial environments constitute public health problems. Smaller plants are of especial concern, as the larger industries which maintain adequate medical service are in a position to cope with these problems.

The present report also presents information on industrial welfare facilities and control measures.

The report is the ninth now completed of similar surveys stimulated by the Public Health Service in various States (Maryland, Virginia, South Carolina, Utah, New Hampshire, Idaho, Maine, and Indiana). INDUSTRIAL MEDICINE* has already reviewed the background and some of the earlier of these State surveys, which began with that by J. J. BLOOMFIELD and MARY F. PEYTON, of the U. S. Public Health Service, in Maryland (U. S. Public Health Bulletin 216, 1934). A number of others are now in progress.

This Illinois survey covers the extraction of minerals, chemicals and allied industries, cigars and tobacco, clay, glass and stone, clothing, food, iron and steel, machinery and vehicles, the nonferrous metal industry, leather, lumber and furniture, paper, printing and allied industries, textiles, miscellaneous manufacturing, personal service, laundries, and dry cleaning and dyeing. Extensive statistical tables, showing the essential data and relations, comprise the bulk of the volume. Appendix A gives an interesting discussion of field work technique for which 15 engineers were chosen after contacting the American Chemical

* Evaluation of the Industrial Hygiene Problem of Illinois. Illinois Department of Public Health, Division of Industrial Hygiene. DR. MILTON H. KRONENBERG, Chief. Chicago, 1939, 258 pages.

* December, 1938, Vol. 7, No. 12, pp. 753-755.

Society and the Western Society of Engineers. These were given a week of intensive training, part of which was under Public Health Service and part under the staff of the Illinois Division of Industrial Hygiene, and the remainder devoted to three days of supervised field surveys. Each surveyor was then assigned approximately 15 plants per week, each of which had been sent a previous form letter of explanation (as shown) after which the survey was conducted chiefly according to two standard forms of inquiry used in other State surveys. Once each week the surveyors were assembled for reports, comments and criticisms — also follow-ups where data were not satisfactory. By this procedure, 57 of the 102 counties in the State were covered. Since Cook County is by far the largest industrially in the state, approximately 53% of the plants and 57% of the workers surveyed were in this county. A map of the State by counties shows the extent of the survey in each — number of plants and number of workers. A total of 303,251 workers was covered.

Appendix B, entitled "General Considerations," points out that the technique of editing was essentially the same as set forth in the U. S. Public Health Bulletin 236 to which is attached an interesting discussion of the exact procedures followed by each investigator, the qualifications and duties of the editor, implying a long experience and considerable knowledge in chemical and industrial processes in order to check the returns of investigators and to apply mature judgment in classifying many borderline classifications and to substantiate personal opinion. Thus an endeavor was made to weigh in an adequate manner the probability and intensity of a given exposure. Two or three examples are given to illustrate how such judgments were effected, the plan being to use conservation in the allocation of hazardous exposures.

Of the 303,251 plant workers covered, 184,181, or 60.7%, were exposed to specified industrial materials and by-products, each worker having an average of 2.1 exposures. From this it is estimated that the total number of exposed workers, had they all been covered, was 697,310. To specified materials, the estimated number of exposed workers was: Organic dust 117,591, silicate dust 112,107, silica dust 75,674, non-siliceous dust 56,844, and asbestos dust 3,425; to toxic elements and their compounds: Lead 56,645, chromium 11,894, cadmium 3,064, arsenic 1,605, mercury 1,090, selenium 591, phosphorus 328, radioactive materials 222; and to various solvents: Other organic solvents 65,333, alcohols, esters and ethers 32,718, coal tar products 13,949, halogenated hydrocarbons 5,392.

—*Analyzing Silicosis Claims*—

ACCORDING to the *OIC Monitor** Safety Engineer LESTER MERRITT, of the Division of Safety and Hygiene, has made a check of the silicosis claims allowed by the Commission from July 31, 1937, the date silicosis was added to the list of compensable occupational diseases, to July 26, 1939.

"During this approximate two-year period, a total of 65 silicosis claims have been favorably considered by the Commission and Mr. Merritt finds that 33, or 50.8% of them, originated in foundries; 24, or 36.9%, in the ceramics industry; 5, or 7.7%, in cut stone operations and 3, or 4.6%, in miscellaneous plants.

"The figures given do not necessarily indicate that silicosis hazards are more pronounced in the industries having the highest percentage of approved claims, since the extent of exposure, as represented by the number of persons employed, must be taken into consideration.

"The check of silicosis claims is but one of the steps being taken by the division to gather data on dust hazards in Ohio industries and to devise approved methods for their elimination."

* Bulletin of the Industrial Commission of Ohio, July, 1939, p. 108.

—*Disabling Morbidity Among Workers*—

PERIODIC reports on disabling sickness and non-industrial injuries from industrial plants in certain large eastern and east-north central states as well as South Dakota and Canada are included in this brief report of the U. S. Public Health Service.* About 170,000 workers are covered, representing the male membership of mutual sick benefit associations, group insurance plans, and company relief departments. The data deal with disability lasting more than one week.

Summarizing Table 1, where the second quarters of 1939 and 1938 are compared, influenza and grippe showed a frequency for 1939 that was almost twice that for 1938. There was also an excess for 1939, but not so great, when the first quarters are compared.

In comparing the rates of the first halves of 1939 and 1938, it is noted that influenza and grippe played an important part in the increase of rates for the respiratory diseases as a group, and in the rate for all sickness.

A second table, covering the first halves of the years 1930-39, shows that the frequency rates for non-respiratory diseases during this 10-year period fluctuated about a mean annual rate of 46.0 per 1000 males, with a lower limit of 41.8 in 1934 and an upper limit of 51.5 in 1930, the rate for 1939 (43.7) exceeding only the minimum rate given for 1934. The table shows a downward trend for non-respiratory diseases which is of sufficient magnitude to arrest attention.

The rates for "neurasthenia and the like" and "other diseases of the nervous system" (except neuralgia, neuritis, and sciatica) have been summed for the first halves of 1930-39. The mean annual rate for this period was 2.4 per 1000 males. The maximum (3.0) occurred in 1939 while the minimum (2.0) was yielded by the first half of 1939. "The downward trend of the rates over the 10-year period is of more than ordinary interest."

* Disabling Morbidity Among Industrial Workers, Second Quarter and First Half of 1939. U. S. Public Health Service, Washington, D. C., 4 pp., mimeo, September, 1939.

Prontylin and Neoprontosil

—*Their Use in Industry*—

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SINCE Domagk's notable work with azobenzene sulfonamide derivatives, a very extensive literature has accumulated in evidence of their efficacy in the treatment of such diseases as streptococcic meningitis, puerperal sepsis, erysipelas, scarlet fever, gonorrhea and other bacterial diseases. Although the precise mode of action of these drugs on bacteria has not been determined, clinical evidence has shown that the sulfonamides have a marked curative action in such diseases. I feel, however, that one field of action of this new therapeutic agent has been neglected. Very little consideration has been given to the value of the sulfonamide compounds in the prevention and treatment of infections resulting from industrial wounds.

In order to determine the efficacy of Prontylin and Neoprontosil in the treatment of industrial injuries, I chose one of our local industrial plants where the opportunity for observation and analysis of the results of such a clinical investigation was unusually good. In accordance with the modern trend in medicine, I felt that the emphasis should be placed on the prevention rather than the treatment of such wound infections. Lacerations or puncture wounds, irrespective of size, type or degree of contamination, were included in our series.

My investigation of the prevention of infections in traumatic wounds was stimulated by the following cases of factory injury which were treated with sulfanilamide.

In the latter part of 1936, a workman reported to us with a severe infection of the left hand and forearm which resulted from a small sliver puncture wound of the index finger. Multiple incisions were made in the hand and forearm, and convalescence appeared to be progressing favorably until the incisions were nearly healed. At this time, there was a sudden exacerbation of all symptoms; severe acute local inflammation, accompanied by a temperature of 105° F, rapid pulse, and marked general malaise. Culture from the infected area was positive for streptococcus hemolyticus. In view of the enthusiasm then current in medical circles for the antistreptococcic properties of sulfanilamide, it appeared to us worthwhile to try this new drug. Twenty grains of Prontylin (sulfanilamide, Winthrop) were administered every three hours for 10 days. Forty-eight hours after the first dose the temperature returned to normal. After several days, during which there was a slight serous discharge, the remaining unhealed incisions closed. There was no further exacerbation of the infection.

Twenty employees suffering from injuries to the fingers and hands and exhibiting symptoms of an ascending lymphangitis upon reporting for treatment, were given 10 doses of 20 grains each of Prontylin over a period of three days. Of these patients only one developed a subcutaneous abscess. In the remainder the clinical course was such that none lost any working time as a result of his injuries. Since there is no uniformity of opinion as to the proper dose of sulfanilamide, I endeavored to obtain a high concentration of the chemical in the blood as soon as possible and maintain it. I continued to give similar doses of Prontylin to occasional cases during the period of January 1 to June 30, 1938.

Prontylin in 10 doses of 20 grains each was administered over a period of three days as a routine procedure for the following year (January 1 to December 31, 1938). However, it may be noted here that during the last six months of this year we reduced the original dose of Prontylin to three 20-grain doses to be taken in the first 24 hours. During the period from January 1 to June 30, 1939, we replaced Prontylin by the less toxic Neoprontosil (Winthrop). The use of the drugs was not resorted to as a substitute for the careful cleansing of wounds, their débridement, removal of foreign bodies, etc. The investigation and report, therefore, pertain only to the value of these drugs as an adjunct to the surgical and antiseptic treatment of wounds. For the purpose of comparative analysis, the results of routine surgical treatment of similar accidental wounds are listed for the pre-sulfonamide period, January 1, 1935, to June 30, 1937. For comparison it also appeared worthwhile to tabulate the total time lost and the expense involved because of the disabilities directly due to the infections. It might be added that the financial expenditure refers to the expenses incurred in addition to the employment of the routine medical facilities at hand. These include such items as x-ray plates, anesthetics, compensation, hospitalization, etc.

From the accompanying table, it is apparent that Prontylin and Neoprontosil have a marked influence on the incidence of post-traumatic infections. The number of infections decreased from an average of 4.27% for the period, January 1, 1935 to June 30, 1937, during which no sulfanilamide was used to 1.58% for the period of July 1, 1937, to December 31, 1938, during which time Prontylin was prescribed, and to 0.6% for the six-months' period during which Neoprontosil was administered. This marked drop in the number of infections is most striking. These results are presented in Chart 1. There was also a marked decrease in the expense of extra medical care during the period in which the sulfonamide compounds were used. The total expense for additional items, such as x-ray plates, anesthetics, compensation and hospitalization, for the pre-sulfonamide period of January 1, 1935, to June 30, 1937, was $8,953.92. During the succeeding six months in which Prontylin was given occasionally, it was only $169.54, and 0.0 for the one and a half year period during which Prontylin and Neoprontosil were administered routinely. The pronounced decrease in expense is especially important to industries which are self insured. The employees were subjected to less suffering,

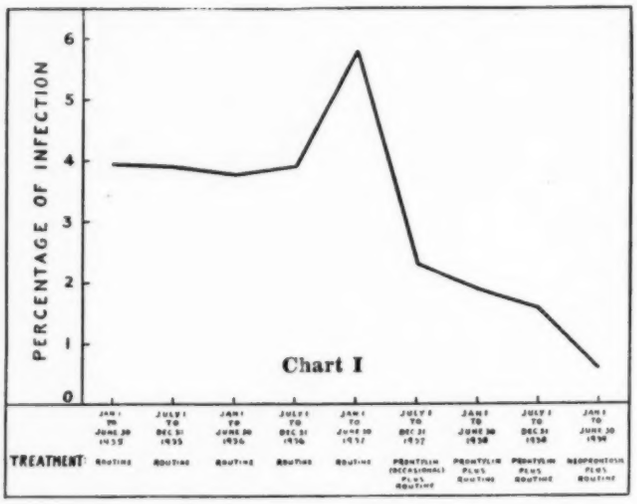

Chart I

had no permanent disabilities, and lost less time from work. In the period before the institution of Prontylin and Neoprontosil prophylaxis, the time lost from work was 127.2 weeks; the time lost during the period in which Prontylin and Neoprontosil were administered was 5.2 weeks.

Although I have used Prontylin and Neoprontosil in the prophylaxis of industrial wound infections for only a short time, the above results seemed encouraging. Certainly, if these drugs prevent even a small number of infections, they deserve more than casual interest. It should be kept in mind that any infection which is prevented spares the patient suffering, and loss of time and money which, in some instances, assumes the proportions of a crushing burden.

Because of the side-effects sometimes experienced with the sulfonamide compounds, patients were observed closely and all untoward reactions were noted. During the period in which Prontylin was given, three patients developed a maculopapular rash and one, urticaria. Some patients (about 30%) complained of transient nausea, anorexia, weakness and dizziness. At no time were marked anemia, cyanosis, jaundice, or other serious complications encountered. Several employees received the prescribed prophylactic dose of Prontylin five or six different times within six months without experiencing any unfavorable reaction. Nevertheless Prontylin was not given to any employee who appeared anemic or who was exposed to occupational hazards, such as benzene, gasoline or lead. With each course of sulfanilamide the patient was instructed to avoid taking any form of magnesium sulfate or exposing himself to undue amounts of sunlight. It was also recommended that water be taken copiously. None of the employees treated lost time from his work because of side-effects.

Neoprontosil was substituted for Prontylin on January 1, 1939, and continued for the following six months. The dosage employed was 20 grains for three doses to be taken within 24 hours. In so far as possible an effort was made to administer the drug on an empty stomach. In spite of this fact there was one case with marked intolerance to the drug. In this series of industrial cases Neoprontosil was administered only by mouth. Neoprontosil seemed not only to decrease the number of infections, but also to produce fewer side reactions than sulfanilamide. Toxic reactions occurred in only 15% of all cases treated. On the

TABLE I

	Period	Treatment	Total accidental wounds	Number of infections	Infections per 100 accidents	Loss of Time		Expense*
						Number of cases	Time lost in weeks	
A	Jan. 1, 1935 – June 30, 1935	Routine	6,390	252	3.94	19	58	$2,927.03
B	July 1, 1935 – Dec. 31, 1935	Routine	2,566	100	3.89	5	22	1,729.10
C	Jan. 1, 1936 – June 30, 1936	Routine	2,658	100	3.76	5	5	1,130.72
D	July 1, 1936 – Dec. 31, 1936	Routine	2,848	111	3.89	3	18.8	1,630.79
E	Jan. 1, 1937 – June 30, 1937	Routine	3,703	214	5.78	15	23.4	1,536.28
F	July 1, 1937 – Dec. 31, 1937	Routine and Prontylin occasionally	3,178	73	2.29	2	5.2	169.54
G	Jan. 1, 1938 – June 30, 1938	Routine and Prontylin routinely	2,045	39	1.89	0	0	0
H	July 1, 1938 – Dec. 31, 1938	Routine and Prontylin routinely	1,829	29	1.58	0	0	0
I	Jan. 1, 1939 – June 30, 1939	Routine and Neoprontosil routinely	2,313	14	0.60	0	0	0

* Not included in this column is the cost of routine medical facilities. These figures include all exceptional expenses accompanying serious infections such as x-ray plates, anesthetics and hospitalization.

whole, the reactions were very mild; nausea, vertigo, fatigue and vomiting were the chief complaints. Chills, fever, vertigo, weakness, and general malaise occurred in only one case. In no case did cyanosis, jaundice, tinnitus, dermatitis or diarrhea appear.

During these six months only 14 infections occurred, and only in one case did suppuration set in. In this case the suppuration followed a puncture wound of the right index finger. Culture from the infected area disclosed the staphylococcus albus in symbiosis with the streptococcus hemolyticus. This patient stated that although he took one dose of the drug, he failed to take the other two. After incision he was again placed on Neoprontosil—20 grains three times a day. Recovery was rapid. He lost no time and no complications resulted. The other 13 cases included infections of the hand, wrist and the preolecranon area. The findings consisted mainly of marked redness, swelling, pain, and a slight serous discharge in some instance. In the bursal case the bursa was filled with serous material, but as the infection subsided, the fluid became absorbed. There was no loss of time in any instance. It is my opinion that Neoprontosil helped to decrease the number of infections from 1.6% to 0.6%. I feel that it not only gave results at least as good as sulfanilamide, but that it also decreased the number of toxic reactions. In only one instance where Neoprontosil failed to eliminate the infection completely, an addition of about 10 grains of Prontylin to the dose produced the desired effect and resolution of the infection.

It is probable that the scheme of treatment outlined here might have to be adjusted to meet the peculiar requirements and conditions of other industries. Nevertheless I feel that the value of some form of sulfonamide prophylaxis has been demonstrated.

WHILE conducting this investigation, several cases of appendicitis came to our attention. To add emphasis to the beneficial influences which Prontylin may have on mixed infections, I would like to digress slightly from the consideration of industrial wounds and include our results in these cases of ruptured appendix with spreading peritonitis. In the three patients referred to me the appendix had ruptured 24 or more hours previous to operation. It was found that the peritoneal cavity in each instance contained some free liquid feces, so that the presence of mixed infection was certain.

In each case 20 cc. of Neoprontosil (2.5% solution) was administered intramuscularly four times daily. Nevertheless the temperature per rectum remained between 103° and 104° F. Sulfonamide therapy was discontinued immediately upon the occurrence of cyanosis and nausea. Cessation of therapy resulted in each instance in an increase of temperature to 105° or more within 24 hours and retrogression in the patient's condition. Under such conditions transfusion of citrated blood was given, and after a day or two in which the pyrexia did not subside, Neoprontosil injections were resumed. These injections were again accompanied by a drop in temperature and improvement in the patient's condition. In most of the cases smaller doses of Neoprontosil were given in the face of untoward reactions without bad effect.

Although the formation of secondary abscesses was not prevented, I feel that a definite localizing effect was produced. Of the three cases, two developed secondary abscesses on the left side, while the remaining patient recovered without further surgery. Each patient received several blood transfusions. I believe that Neoprontosil had a definite favorable therapeutic influence on the above three cases and without doubt had produced a marked aleviation of symptoms and assisted materially in the eventual recovery of the patient.

Comment

AT THE present time, I do not believe that Prontylin or Neoprontosil should be administered routinely unless patients can be kept under constant observation. The physician must proceed with caution, fortified with a knowledge of the contra-indications and possible reactions which may arise due to individual intolerance or sensitivity. The effect of Prontylin and Neoprontosil in certain streptococcic infections as evidenced by a large and growing literature has been confirmed. However, there has been some difference of opinion regarding their deterrent action on certain other organisms, such as the staphylococci and spirochetes.

While it is not my intention to be dogmatic on this subject, my impression is that infections following traumatic wounds and perforated appendices should not be considered unsuitable for Prontylin or Neoprontosil therapy, even when due to more than one organism. I believe that these drugs exert inhibitory effects on some invading organisms other than the beta hemolytic streptococcus—possibly by mustering the immune resources of the body and thus aiding the body defense mechanism. In this way the sulfonamides prevent a serious overburdening of the body's resistance and may in this way prevent a fatal outcome.

It is apparent from the rapidly accumulating literature dealing with the therapeutic value of Prontylin and Neoprontosil that these drugs have been employed in the treatment of almost every known disease. Undoubtedly, some of the claims are unfounded. However, this point should not be over-emphasized, for the drug often produces spectacular results which are entirely unexpected. Not unlike previous investigators, I am enthusiastice regarding the use of Prontylin and Neoprontosil, particularly in the treatment of traumatic wounds.

The careful study of the prophylactic use of the sulfonamides will be continued. It is sincerely hoped that this preliminary report will stimulate others engaged in industrial practice to investigate the possibilities of the prophylaxis of industrial wound infections with the sulfonamide compounds.

Conclusions

PRONTYLIN and Neoprontosil have a valuable and practical application in industrial medicine.

2. Prontylin and Neoprontosil appear to prevent the occurrence of infection in traumatic wounds when administered prophylactically in adequate dosage.

3. The course of certain mixed infections, such as peritonitis following a ruptured appendix, is influenced favorably by Prontylin or Neoprontosil.

[The author wishes to express his gratitude to Mr. R. K. Hettrick, R.N. for his helpful cooperation.]

Obligation of the Railway Surgeon

CALVIN A. WALKER, M.D.,
San Francisco, California

WHEN we speak of doctors engaged in railroad work, we usually use the title Railroad Surgeon.* This is a heritage from those early doctors whose work for the railroad was confined chiefly to caring for injured employees—they were really traumatic surgeons. Since then, our field of professional duties has been broadened so that presently we are giving medical service as well as surgical service. When the title Railway Surgeon is used here it should be understood to include physicians and specialists in different branches of medicine, as well as surgeons, all of whom are giving professional service to railroad employees.

When we enter the field of railroad work, we assume certain obligations to the industry we serve and to the public. As related to the industry, we have for consideration: first, the company; second, its employees. The interests of the two are so closely related that by serving one we serve the other.

Our responsibility begins with our physical examination of applicants for employment. It is an important matter to the company that only applicants physically fit for service be accepted. Employment in train service of physically defective men endangers the lives of fellow employees as well as the lives of the traveling public, and may result in property loss to the company as well.

The prospective applicant is selected by an employing officer, who refers him to the company surgeon for an examination to determine his physical fitness for employment. In passing on this, we should consider the type of work the man will have to perform. We might accept a man as a track worker or freight handler, and reject the same man should he wish to enter train service. Past illnesses and past injuries should be considered, as well as past occupations. The company is entitled to protection against unjust claims for compensation because of pre-employment disease or injury which later might become troublesome. I have in mind here the recent prominence given to silicosis as an occupational disease. Indeed, the time may come when industry, in self-protection, may require x-ray examination of the chest and possibly of the spine as well. An x-ray film of the chest taken at the time of employment, would be a permanent record of the condition of the organs in the chest and could be used for comparison with films which might be taken later on. It follows that a man showing lung pathology on roentgen examination, would not be placed in an occupation where he would be exposed to dust. An x-ray film of the spine, taken at the time of examination would often show abnormalities, both congenital and acquired, which later on might be a contributing factor in prolonging the length of disability in back injuries. We have all had experience with an old pre-employment osteomyelitis which may light up after the man had been in employment for a time, and which will result in loss of time from work and require a long period of treatment at the company's expense. The physical findings will determine whether the applicant be accepted or rejected; but I sometimes feel it would be well if we might also include mental defects in our examination and be authorized to reject certain hypertonic, erratic individuals and morons who later on are almost sure to become troublemakers. However, at present, the hiring officer satisfies himself as to the man's temperamental fitness and other qualifications for the position to be filled, leaving it to us to determine his physical fitness.

The traveling public appreciates the effort we make through special blood, feces and x-ray examination of food-handlers, to keep this group of employees free from communicable diseases.

Our interest in employees does not end with the initial physical examination, for as long as they remain in employment with the company they should have our medical supervision and we should stand in the same relation to them as we do to our private patients. They should have the benefit of our knowledge of preventive medicine. Most companies provide for a systematic periodic physical examination of their employees, which is part of preventive medicine. This periodic examination should not be made with the idea of taking men out of service, but rather to make it possible for them to continue in employment. It is done in the best interest of the employee and for the purpose of uncovering defects that might disable him, and taking steps to remove this threatened disability, if this is possible. One should not expect the company to retain incapacitated employees, however, when by so doing it would incur undue risks. It is in the best interests of all concerned that we take out of service incapacitated employees, recommending for pension those who possess the necessary qualifications.

We should not concern ourselves with the health of the individual employee alone, but should go still further and advise him as to safe working conditions and as to proper sanitation. This latter will also concern the health of the man's family.

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* Presented at the Fiftieth Annual Meeting of the American Association of Railway Surgeons, Chicago, September 12, 1939.

Properly trained railroad physicians and surgeons should be classed as industrial specialists. To be considered in this specialist class, they should be skilled in medicine, proficient in surgical technique, and familiar with surgical procedure demanded in their work; and they should possess further the necessary qualifications to administer the affairs of the department, which will include such things as making reports of accidental injuries, the condition of health of the employees, the disposition of cases of disabled employees, and advice to the executive department as to the sanitation of cars, shops and points along the road. Regulations of the Hospital Department of the company which I serve provide that: "Division and district surgeons will be expected to pay strict attention to sanitary conditions at all points of the road within their jurisdiction or where employees live in large numbers, and to report at once to the Department anything coming to their notice detrimental to the health of employees or passengers."

WE SHALL now consider our obligation to both the employee and the company in the event a worker is injured while on duty. We act in a dual capacity here. We must be fair to our patient, and we must be fair to the employer. The injured worker should be given prompt and efficient care, not neglecting what appears to be a slight injury at the time, but which may, through neglect, prove to be later a port of entry for virulent organisms causing serious infection which may result in disabling deformities—this is especially true in injuries to the hand.

In passing, may I call attention to the meticulous care demanded in the treatment of compound fractures and to the importance of prompt reduction of all fractures. The thought uppermost in our minds during our treatment of the patient should be: "How nearly can I restore him to normal, and how soon?" This is important to both the injured worker and the company.

During the course of our treatment, which may extend over a considerable period, we must tell our patient something about the outcome of his injuries. How much shall we tell him? This depends on his temperament and intelligence. Some possess the fortitude to "take it on the chin," and this type of man can be talked to quite frankly. Others are more timorous, and it is better not to tell them too much for the time being. Personally, I am inclined to discuss matters with them quite freely, being guarded, however, in my statements in the case of neurotics. We should impress the patient with our interest in him and not permit him to feel that we are withholding anything from him, lest we lose his confidence. Our attitude toward him should be one of cheerfulness. By this I do not mean a "Pollyanna" attitude, but rather maintaining a presence that will inspire confidence and optimism.

There is an increasing tendency on the part of claimants to malinger or exaggerate, and this complicates our problem. When we suspect our patient is malingering we find ourselves in a battle of wits. We are trying, on the one hand, to catch him off guard and he, on the other, is trying to circumvent us. The surgeon should never, by word or action, allow the patient to sense the fact that he is being suspected of malingering. He should be carefully but unobtrusively watched, examined from time to time and encouraged to re-enact the accident and discuss his symptoms just as much as he pleases. He will be almost sure to overact or make misstatements which will prove his undoing. It is unfair, not only to the employer, but to the public as well, for a false claim to be paid. Money so paid out must be added to the company's overhead and, in the last analysis, the public pays such costs, which must be passed on to them.

What is our obligation to the company in personal injury cases? As I said, we should endeavor to restore the worker to as near normal as is possible, and as soon as is consistent with proper treatment. We must consider what is expected from us by the Legal or Claims Department. Since they must compensate the man for his injuries, we must furnish them accurate information as to the extent of the injuries, so that they may be in a position to settle the claim intelligently and equitably. To properly advise the Claims Department as to the man's injuries, it will be necessary for us to take a full history of the accident, inquire into all the circumstances surrounding it, make a thorough examination, after which a full written report of our findings should be made, together with our opinion as to how long he will be disabled, whether or not there will be any permanent disability and if so, how much, and if he can return to his former occupation.

In our first report we should endeavor to paint a clear picture of the injury and the damage done. The surgeon should avoid any tendency to underestimate the amount of disability. It is perhaps better to overestimate than underestimate. The Claims Department wants the truth, the whole truth, and nothing but the truth. The plaintiff's lawyer will not agree with this. He will attempt insidiously to suggest to the jury through his questioning that there is collusion between the Medical Department and the Claims Department.

A certain number of personal injury cases will go to trial, the number depending largely on the activities of the ambulance-chasing lawyers in the community. Testifying in court in a damage suit is distasteful to most railway surgeons, and the more skillfully the patient is handled during his treatment by the surgeon the less likely will he be to bring suit. Any case being treated for injury may later become a court case, so it is very important that the attending surgeon make full written notes at the time of examination, which notes should be preserved at least until after a settlement has been made. They will be of utmost importance to us as a witness when called to testify. The plaintiff, if exaggerating, is at a disadvantage when original written notes made at time of examination are produced while testifying.

The x-rays taken during the course of our treat-

ment are produced in court. The evidence they give is limited to proving whether there has been a fracture or a dislocation in a given injury. Later films will show the end results of our treatment. They are not a measure of the disability resulting from the injury to the same degree as are clinical findings. We have all had cases of head injury which on roentgen examination showed a linear fracture of the skull with but few symptoms of brain injury, and we have also had cases of head injury where roentgen examination failed to show a fracture of the skull but there were present symptoms of severe brain injury. In head injuries, the damage done to the brain is not measured by the fact that there was present a fracture of the skull, but is measured rather by the clinical findings and objective signs. A better measure of brain damage is the period of time the patient remained unconscious following the head injury, together with the length of time the symptoms and signs persist while under treatment. The plaintiff's lawyer also may introduce in evidence x-ray films taken by a doctor of his own selection. Qualified roentgenologists may be called on each side to testify, and they may oppose each other in their interpretation of the x-ray films presented to them for reading. This controversy in testimony has a tendency to cloud the issue so far as the jury is concerned, and possibly raises the question of veracity. In such a situation the testimony of x-ray experts is of doubtful value. When we are called to the witness stand, we should avoid showing any prejudice by our testimony, we should be fair-minded and present the facts in the case to the jury in language they can understand and when cross-examined by the plaintiff's lawyer, we should stand by our guns, and not allow him to confuse the facts and raise a question of doubt in the minds of the jurors.

IN CLOSING I wish briefly to discuss a matter that interests me as a citizen rather than as a surgeon. We are first citizens of a nation and, after that, surgeons, serving the public both in private practice and in railroad work. I believe we can all subscribe to the slogan "Railroads build the nation." As railroad surgeons we are an integral and important part of the road and we are not without influence in our community. I feel it is only our duty to make our friends realize the importance of railroads to the nation, to sell to them the idea of giving their support to the railroads. All of us can readily appreciate the military importance of the railroads in time of war. Because of our close relation with the roads, we know the difficult problems they have to face. We know that some roads have gone into bankruptcy or receivership, and unless the regulation and restriction of them on the theory that they are a "monopoly" is modified, other roads may have the same experience, so that eventually they may all have to be taken over by the Federal government. I feel a great misfortune would befall our country should the railroads come under government ownership and government operation.

The following quotation from a booklet published by the Association of American Railroads expresses concisely the thought I wish to leave with you:

"A square deal in transportation — with equal rights for all and special privileges for none — is all that the railroads need to enable them to continue providing America with the finest transportation service the world has ever known!"

Trauma of the Larynx

PROFESSOR CHEVALIER JACKSON
and
PROFESSOR CHEVALIER L. JACKSON
Professors of Bronchology and Esophagology, Temple University, Philadelphia

TRAUMA of the larynx, like trauma anywhere else, may be psychic or anatomic.* The psychic form is seen less frequently and has always been confused with malingering, but it does occur and it is at times genuine. For example, a number of years ago a front flagman riding on the cab of the locomotive was struck on the larynx by the reverse pull of a fireman who was dragging clinkers out of the fire-box. This set up a psychic condition (which DR. HARDING[1] would fully understand and could better explain to you). There was a slight interference with motility in the larynx at first but that quickly disappeared. This man claimed he could not talk, notwithstanding the fact that the movement, color of the mucosa and the innervation were all perfect. With this perfect mechanical condition the patient can phonate if he wants to phonate. But this man claimed he could not say a word. He put in a claim for total disability, and the matter was referred to us. Observing that the motility of the larynx was perfect, we sent him to a neuropsychiatrist with the diagnosis of a functional condition to be treated in the same way as hysteria. This resulted in a complete cure and he withdrew his claim for compensation. The facts that he withdrew the claim, that he could get stability, could master that psychic phenomenon and get completely well proved the condition was not malingering. There is only one way to make a differential diagnosis between anatomic and psychic trauma and that is by examination of the larynx. If its mechanism and innervation are perfect the patient can talk.

So much for psychic trauma of the larynx. Anatomic trauma is much more common and, like other anatomic things, more pleasant to treat. The most common cause of trauma of the larynx is vocal abuse. Some people talk all the time they are awake. Talking on railroad trains used to be a common cause of hoarseness in singers and speakers; they would talk all day, forcing the voice so as to be heard above the noise of the train and to this they would add the tremendous

* Abstract of a lantern and chalk demonstration at the Forty-Ninth Congress of Railway Surgeons.

strain of their professional work in the evening. Of course, air conditioning and closed windows minimize that difficulty in our best trains today.

Another form of trauma is tobacco. Chewing tobacco does not injure the larynx; but tobacco smoke does. A little will do little harm, much will do a great amount of damage. It is not the nicotine but the empyreumatic oil produced in the destructive distillation of the burning tobacco that does the harm.

Other forms of trauma are related to the fashions. The fashions determine the form of the injury. In the old days it was the fashion to disable a man first and then administer the "mercy stroke." In the attempt to do this the larynx was often cut. Another thing that is out of fashion is the cutthroat. Formerly the ambition of each young criminal was to be a cutthroat. Fashions have changed and now the young criminal wants to be a gunman, or a "two-gun" man. The difference is this: the cutthroat always stabbed for the neck and often cut the larynx; on the contrary, the neck forms a very narrow target for the revolver. Our present day criminal does not try to shoot in the head unless the gun is in contact with the head. The gunshot wounds today most often are in the abdomen and chest, but occasionally there is a gunshot wound through the larynx. We get a good many cases of suicide with injury to the larynx, some of them with a razor and some with a dagger, but even this has been replaced by forms of suicide that do not so much concern the larynx. The remorse that comes after alcohol leads to jumping out of windows. Our pupil DR. LOIS GREEN informs us that in China they still see a great many lacerated larynges from suicides; they do not have high buildings, so they cut their throats with a razor or scissors, or a piece of glass. In this country lacerations of the larynx are common. Another form of trauma is tramping on the neck. This used to be caused mostly by horses, but they are disappearing. Sometimes cattle tramp on the neck. Not infrequently a football player tramps on the neck of another player and causes a fracture of the ossified portion of the thyroid cartilage.

High tracheotomy is a frequent cause of trauma to the larynx. The low tracheotomy is much quicker and more certain than the high one, but the textbooks still mistakenly advise the high procedure.

One of us (C.L.J.) has at the clinic cases of laryngeal stenosis of which fully half are traumatic; the other half were caused by diphtheria and high tracheotomy.

IN REGARD to pathology, the outstanding feature of laryngeal trauma is poor repair of the cartilage. The repair of cartilage is poor anywhere in the body, much poorer than bone, but it is especially poor in the larynx. There is an enormous difference between an incision or a trauma to the external perichondrium that does not penetrate the internal perichondrium and one that does. If the internal perichondrium is not penetrated the trauma of the larynx will heal up as promptly as it will anywhere else; but if the internal perichrondrium is traumatized it means a year or two of trouble and treatment. Those are the characteristics of the pathology of trauma of the larynx.

SYMPTOMATOLOGY: The chief symptoms are hoarseness, hemoptysis, pain, tenderness, emphysema, dyspnea and asphyxia.

DIAGNOSIS: The only way of making a diagnosis is by direct and indirect examination inside, direct examination outside, and, above all things, palpation. The left index finger is placed on the patient's left side and the right index finger on the right side and between the two you can map out the layrngeal cartilages perfectly. If there is the slightest defect in those cartilages it can be detected by the fingers. The roentgen-ray is useful and should always form part of the examination, but it is not always reliable if negative; and it often is negative in cases of fracture of the thyroid cartilage.

TREATMENT: Almost invariably trauma of the larynx is associated with edema, and that means asphyxia, unless averted. It is particularly necessary to get the patient into a hospital as quickly as possible. If it is likely to be more than an hour before he can get to a hospital, somebody had better be with him prepared to do a tracheotomy. Dyspnea and asphyxia come on quickly and in the final stage supervene precipitately; therefore, the patient should not be transported without someone with him who can do a tracheotomy if necessary.

Another point is this: Our experience shows that often attempts are made to close the wound and even to stitch the divided cartilage. This is a mistake. No attempt should be made to suture the laryngeal cartilage. The wound should be packed open until danger of virulent infection is over and fibrous union of the cartilage has been completed.

Another point is to beware of morphine. It should not be given to any patient with dyspnea or impending asphyxia.

SEQUELAE: Laryngeal stenosis occurs in fully half the cases that have had a severe laryngeal trauma. Such stenosis is readily curable, and the patient should not be permitted to drift on into total disability; he can be cured. Even the malingerer can be cured. The cure of anatomic trauma usually takes a long time, and this means a long disability; but ultimately most of the patients can be cured by suitable treatment.

PROGNOSIS: Trauma of the larynx is rarely fatal except by asphyxiation. If that is avoided, the patient will usually go through the acute stage and into a chronic stage; and he can then be cured only by prolonged treatment.

ONE of our cases was a burn of the larynx, producing a tremendous slough which included the thyroid cartilage and two or three rings of the trachea. This left a gap in the tracheal wall. If such a gap were drawn together the patient would develop stenosis with dyspnea, and probably

tracheotomy would be required to prevent asphyxia. The only way to make repair in such a case is to lay on a large flap like a lid, and in that flap must be placed some rib cartilage for stiffening. The rib cartilage is implanted in the tissue that is to be used for a flap, by a preliminary sterile operation.

Another case of ours was that of a brakeman who had been dragged off the top of a car by a wire which caught him in the neck. He became disabled because of the dislocation of both arytenoid cartilages. In all of these cases of dislocation reduction must be done early or there will be great difficulty in restoring function.

In another case a dead wire was pulled across a live electric wire, which came in contact with the larynx and seared into the cartilage. In this man there was a swollen epiglottis, followed by sloughing and necrosis of cartilage. We cannot treat such a case as a surgeon would treat a similar injury in some other region, by cleaning it out and getting primary union. We must wait until the cartilage sloughs out and meanwhile it is essential not to allow total atresia to occur.

ANOTHER form of trauma to the layrnx is that which occurs from corrosive gases — such as in chemical factories, from inhaling caustic fumes. The same thing occurs with firemen when they breathe smoke and flame. In such cases the patient should be watched, though edema requiring tracheotomy is not so frequently a complication as in cases of incised or lacerated wounds. Such cases usually require quiet and rest in bed.

It is necessary in all cases of stenosis to get the laryngeal lumen open early and not to accept the patient as a total permanent disability. Partially disabled he may have been, but usually he is fit for duty after he has undergone treatment.

Cutting by glass is becoming more and more common as glass is being more and more used. The non-shatterable glass has checked this form of injury in automobile wrecks, but there is glass everywhere today and when structural glass starts cracking up in fires there is great danger of glass cuts. Only occasionally, however, does there occur a cut in the larynx from this source.

We do not see as many cases of razor cuts of the thyroid cartilage as formerly, but we still see a few. Even the ossified part of the thyroid cartilage is readily cut through by a blow from a backed razor.

Reference:

1. G. T. HARDING, M.D.: "Mental and Emotional Instability — A Problem of Late Midlife," *Industrial Medicine*, October, 1938, p. 632.

Discussion:

QUESTION: It has been a pleasure to hear this paper. Some of us have seen these cases of gas injury, and the point has come up of carcinoma being related to gas.

QUESTION: I had a case of puncture wound of the larynx. The doctor has not mentioned that, and I wanted to ask him his experience in regard to those cases where air permeates the soft tissues until the neck and chest are emphysematous and edematous. I sent this patient to the hospital and did a tracheotomy, and the patient made a good recovery without any unpleasant reactions.

DR. CHEVALIER JACKSON, (in closing): That is a very interesting point the doctor brought up concerning carcinoma as a complication of gas inhalation. We have not yet seen a sufficient number of cases of malignant complications to prove that they were related to the gassing, but we have observed enough cases of benign epitheliomas, papillomas of the larynx and of the tracheobronchial tree, in men who were gassed in the war, to indicate that these growths occur as a sequel, in a percentage of such cases. We have not had sufficient data to say that gassing causes carcinoma. We know, however, that irritation is one of the causes of carcinoma. We do not know what all the causes are, but irritation is a factor, and those gases are an irritant.

Now about the other condition, the sucutaneous emphysema following punctured wounds of the larynx. The surgeon's treatment of the case was perfect, as shown by the perfect recovery. The subcutaneous emphysema of wounds of the trachea and larynx subsides quickly. The edema of the interior of the larynx does not subside so promptly; often it runs on into a chronic stenosis.

Tuberculosis Occupational!

MR. THEODORE C. WATERS, of the Air Hygiene Foundation's Legal Committee, has given the following memorandum concerning a recent decision by the U. S. Circuit Court of Appeals for the Second Circuit:

"The case of *Grain Handling Company, et al., Appellants* v. *Charles J. Sweeney and Kenneth G. McManigal, Commissioner, Appellees,* recently decided by the United States Circuit Court of Appeals for the Second Circuit, was an appeal involving the construction of the term, 'injury,' within the meaning of Section 902, subsection 2 of Title 33, of the United States Code (Longshoremen's Act). The claimant, Sweeney, had been employed for 25 years as a 'grain scooper;' the last 12 years of this term was in the employment of the Grain Handling Company, Inc. His duties exposed him to considerable quantities of minute particles of dust. In 1918 he had contracted tuberculosis but had recovered, the disease remaining dormant until 1934, when he experienced difficulty in breathing, suffering a return of his former tuberculosis. On June 15, 1936, becoming totally disabled, he discontinued his employment and filed claim for compensation. Compensation was awarded by the Commissioner on the ground that his employment required him to 'work in thick grain dust, causing the latent tuberculosis condition to become active,' and therefore, the injury sustained was an occupation disease. The opinion of the Court, filed by Judge L. Hand, held that the injury complained of was an occupational disease. Judge Swan, concurring, said:

" 'Although I am willing to concur in the judgment I cannot refrain from expressing my doubt whether the interpretation we are putting on the statute does not virtually read out of it the adjective 'occupational' which qualifies such diseases as are made compensable. In effect, we are holding that the lighting up of a latent tuberculosis by the breathing of grain dust creates an 'occupational disease' in the particular employee so affected, although 99% of the workmen may never get tuberculosis as a result of laboring under the same conditions for equally long periods of time.'

"Judge A. N. Hand, in a separate concurring opinion, said in part as follows:

" 'I think it is a fair inference from the proof than any condition of latent tuberculosis is likely to become active by working in grain dust. Many persons are subject to this infirmity and if such persons are likely to develop tuberculosis from working in dust the resultant condition would seem to be an occupational disease — that is, a disease peculiar to and arising from the occupation.' "

Acute Tunnel Gas Bronchitis

—With Case Report—

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A CAREFUL survey of the early literature on the subject of various effects of tunnel and mine gases on the worker disclosed the interesting fact that in the early days of mining, where the working room was extremely small and very inefficiently ventilated, it was found that there was a definite increase in carbon dioxide and carbon monoxide in this poorly ventilated air, which factor precipitated numerous attacks of both bronchitis and asthma. It was also found that miners who had worked in the gold mines, and who suffered from silicosis, were more susceptible to the effects of carbon monoxide.

During the World War it was found that young men were more susceptible to the effects of carbon dioxide and carbon monoxide than men over 40. This is because younger men have a greater elasticity of the chest with deeper inspirations, which, in turn, would create a greater vital lung capacity, and thus, naturally, a more rapid absorption of the gas.

Alcoholism tends to make the men more susceptible to both carbon dioxide and carbon monoxide. Grünewald considers that the possibility of danger of poisoning for human beings varies between 0.03% and 0.3% carbon monoxide in the inspired air, and that the anemic, who have no oxygen reserve at their disposal, as well as workers, who, in the course of their activity, have increased use for oxygen, are more sensitive to carbon monoxide poisoning than the strong, healthy person who possesses a corresponding supply of oxygen.

Most of the literature on the subject of carbon monoxide poisoning brings out the dire effects of the carbon monoxide on the heart and vascular system, as well as the central nervous system, but with very little emphasis on the effect on the respiratory system.

All of the writers stress the anoxemia produced by the formation of carbon monoxide hemoglobin, but very little stress is brought to bear on the numerous cases of lung irritation, as well as the lowering of body temperature caused by the carbon monoxide. The British, during the World War, found that one of the most characteristic effects of carbon monoxide was the lowering of body temperature. This fall of body temperature is brought about, first, by the combination of carbon monoxide with hemoglobin depriving the hemoglobin of oxygen, thus decreasing metabolism; second, the lowering of the vitality of the heat-regulating brain cells by this lack of oxygen. This lowering of temperature is brought out here to show the possibility that the acute bronchitis may be due to the irritation factor as well as the lowering of body temperature. During the World War the gas inflammation of the lungs was followed by a very rapid and serious pneumonia from which many patients died.

Investigators for the Bureau of Mines tested gases in various mines and showed that canaries are less resistant to carbon monoxide than mice, chickens, rabbits, guinea pigs or dogs, while men may display distress in the presence of proportions of carbon monoxide as low as 0.1%. Small animals in the same atmosphere show no signs of being affected. Men working in a mine may develop severe headaches from breathing air containing 0.12 carbon monoxide, while canaries in the same atmosphere are not affected. Canaries, however, do give ample warning when the percentage of carbon monoxide becomes dangerous.

Carbon monoxide per se is not irritating to the bronchial tubes but when in conjunction with other gases, such as carbon dioxide, nitrogen, sulphur dioxide or hydrogen sulphide, does produce a lowering of body temperature as well as sufficient irritation in the bronchial tubes to produce an acute tunnel gas bronchitis, or rather an acute pulmonary congestion.

The tunnel in which our patient suffered his acute gas lung congestion was constructed through volcanic formations. Thus, there was a variation in gases at different levels of the tunnel, depending upon the type of ore, also the environment of the ore, whether wet or dry. Wet conditions increase oxides, and also nitrogen. Soft ground or creviced formations increase the carbon monoxide. Another noteworthy fact is that an incomplete detonation or burning of an explosive creates a tremendous increase in poisonous gases, such as carbon monoxide and oxides of nitrogen. The gases from all explosives must be diluted sufficiently with air before they are safe to breathe.

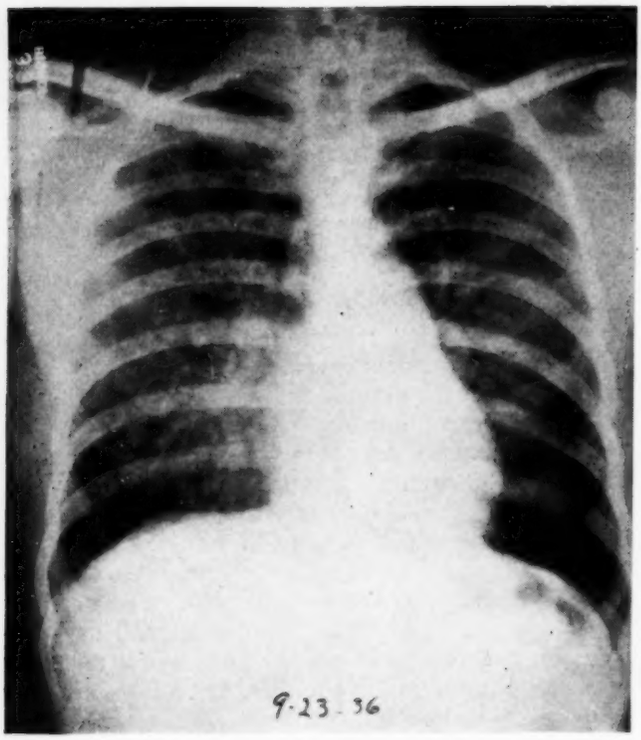
The following factors have a very important bearing on length of time that must elapse after a shot before it is safe in the tunnel heading:

1. The amount of explosive shot.
2. The volume of air into which gases are discharged.
3. Type of ventilation.
4. Secondary reactions that take place and reduce the amount of certain gases, principally carbon dioxide.

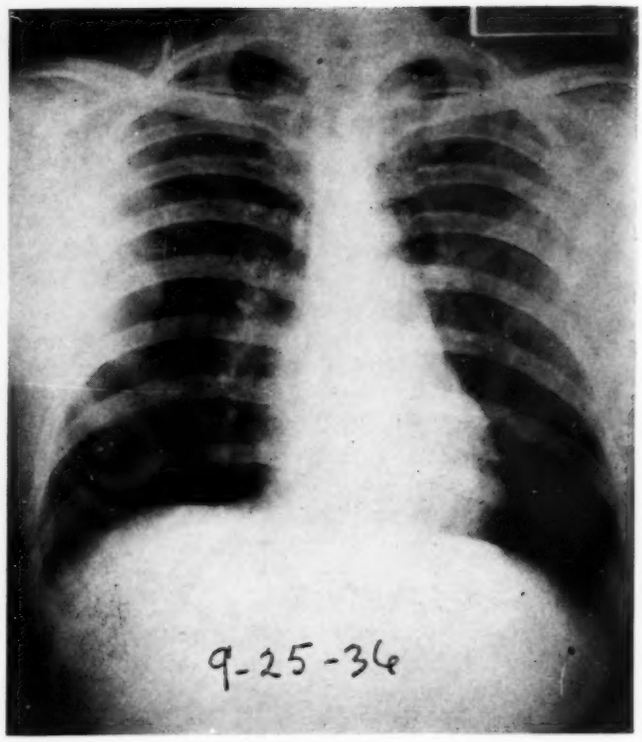
Although it is impossible to give an absolutely accurate analysis of a mixture of gases of detonation in mining where they will be representative of the average conditions, the following percentage of gases are from samples taken on the muck pile 30 minutes after a round of 73.7 pounds of 40% EX.L.F. gelatin in a 45° raise through rock was fired.

Oxides of nitrogen	99 parts per million
Carbon monoxide	0.24%
Carbon dioxide — before shot	0.19%
Carbon dioxide — after shot	0.62%
Hydrogen sulphide	None
Sulphur dioxide	None

Carbon monoxide is slightly lighter than air, and, therefore, diffuses rapidly in open spaces.



X-ray picture taken at the onset of the tunnel gas bronchitis shows extensive generalized involvement in both lungs with snow-flaky mottling and evidence of marked congestive appearance, in many ways very similar to an acute miliary tuberculosis, or even silicosis, since there is such a general appearance of nodulation throughout. Surprisingly, this entire picture markedly changed and cleared up as shown in x-ray taken 9-25-36.



This x-ray shows the acute pulmonary congestion with generalized infiltrative process very decidedly cleared up, however, there is still a considerable increase in density of the linear markings throughout the chest. At no time was the heart enlarged. All of this congested appearance is due to the gas irritation.

However, within closed areas, as in trenches or tunnels, dangerous concentrations frequently occur. Thus it is that during the World War, even though carbon monoxide was not used as a combating gas, frequently it caused casualties due to its generation by the detonation of high explosives. This is the important feature in tunnel gas cases.

Permit me here to cite the actual case of a man who was found unconscious in bed in his room with a gas heater burning. The gas heater was not connected with a flue and the room was closed. When found his blood showed 80% hemoglobin combined with carbon monoxide. Artificial respiration and oxygen proved to be sufficient to revive this individual. The conditions in this room showed that after four hours the air of the room was found to contain .25% of carbon monoxide.

I would like, now, to present our case of acute tunnel gas poisoning with acute pulmonary congestion.

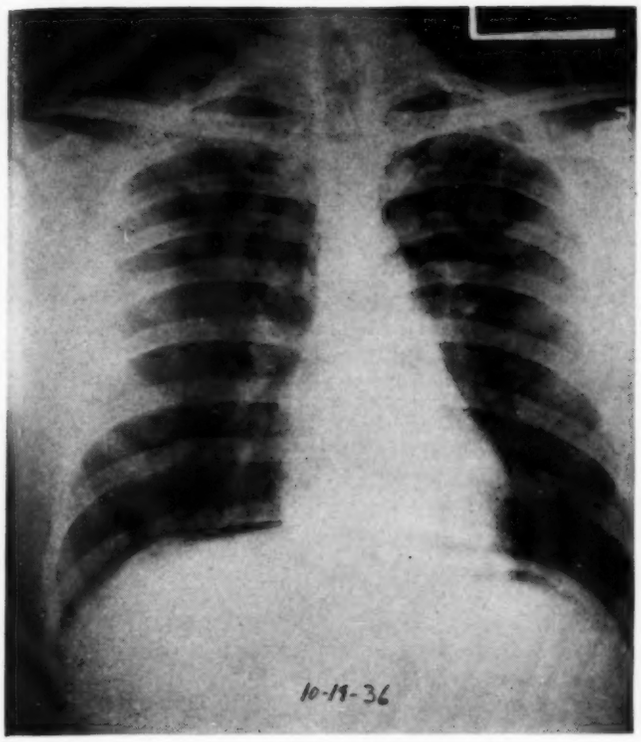
Case Report

MR. J. H. L., age 25, had been with the City Department of Water and Power for 11 months during which time he had worked as an electrical helper in the tunnel heading. His work required him to hurriedly string electrical lights in the tunnel heading as soon as possible after the explosion of the dynamite. Very often it was necessary for this man to work in the heading where there was still a great deal of gas and smoke present following the detonation. The patient had never worked in any other type of mine operation.

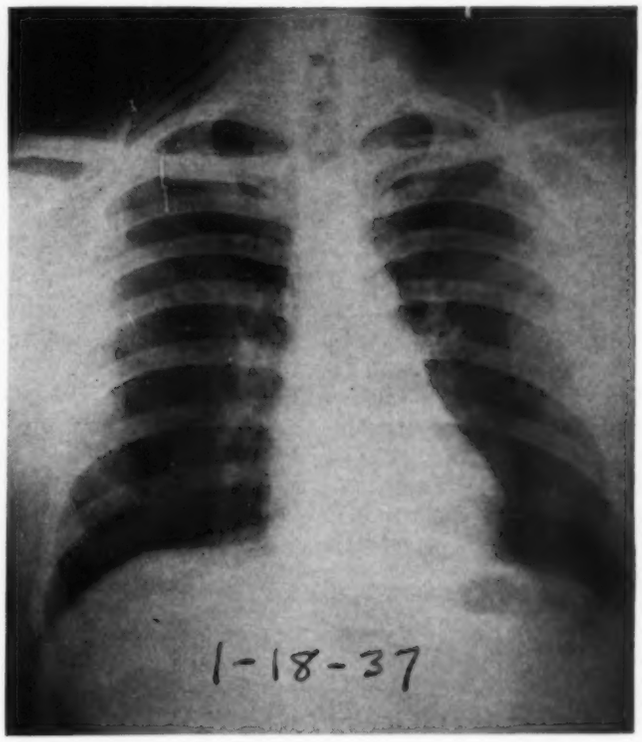
He had never been subject to colds, had never had night sweats, and had never coughed up any blood until one month previous to my examination. During the past month he had lost weight, coughed up mucus streaked with blood, and had begun to run some afternoon temperature. He developed marked general weakness, shortness of breath, sensation of cold, and soreness throughout his chest. He stated that he became markedly worse immediately following the explosion of dynamite, where he was compelled to work in an environment of gas and smoke which precipitated more coughing.

The patient was brought to the first aid hospital, and then to the Good Samaritan Hospital, on September 25, 1936, where my examination disclosed an increase of tactile and vocal fremitus throughout the chest, with harsh expiratory notes and fine crackling rales generalized throughout the lung fields. There were also numerous coarse rales over both primary bronchi and over both bases, posteriorly. There was no evidence of dullness and no evidence of cavitation. Respirations were 28, pulse 72, temperature range from 99° to 100.6°.

The first x-rays taken on this patient showed a very marked generalized and diffuse snow-flaky mottling throughout both lung fields. This picture was taken immediately after the patient was brought to the first-aid hospital on 9-23-36. He was transferred to the Good Samaritan Hospital and re-x-rayed. On 9-25-36, x-ray showed a marked clearing up of this diffuse mottling appear-



This x-ray shows further clearing up of the lung markings, however, this picture is almost within normal limits except for a few discrete nodulations that have persisted. Most of the linear lung markings, however, have entirely disappeared.



This final check-up picture of the lungs taken over four months after the original injury shows the lung findings entirely clear and normal with the exception of slight accentuation of lung markings at the lung root. The very extensive lung pathology as present in 9-23-36, has entirely cleared up.

ance in the lungs. Undoubtedly this man was suffering from an acute gas inflammatory process in both lungs. The pathology here was undoubtedly one of edema and hyperemia of the bronchial tubes. He coughed up fresh blood at various intervals. This condition was also associated with a certain amount of respiratory embarrassment. He ran a continuous evening temperature of between 99 and 100°. His treatment consisted of aeration of the lungs with O_2 and CO_2, intensive diathermy through the chest, a high-caloric nourishing diet, and complete bed rest. Under such treatment he gained 30 pounds. He was discharged from the hospital three weeks after the onset and with normal temperature and normal x-ray and clinical findings.

Check x-rays on 10-19-36 showed progressive clearing up of the dense markings throughout the chest with a clearing up of the previous fine mottled, dense, congestive appearance. Later x-rays taken 1-18-37 showed that the lung fields were entirely clear and normal in every way. (See x-rays with report.) The only noteworthy fact in his rapid convalescence was the tendency to recurrent head and chest colds and associated fatigue.

The physical characteristics of this case were:

1. Acute gas inflammation simulated acute pulmonary tuberculosis.
2. A rapid healing process that occurred with rest and proper lung aeration.
3. Patient was completely recovered within three months and with no permanent evidence of inflammatory changes in the lungs, or lowered resistance on the part of the patient.

It is a well known fact that inflammation of the respiratory system, induced by irritant gases, lowers the patient's natural resistance to secondary invasion by bacteria. Thus, pneumonia is a common complication. It is very probable that the inhalation of gases which would be irritating enough to produce the x-ray picture shown in this report, even though the gas would be in extreme dilution, would predispose to the later development of secondary infection and pneumonia.

The first x-rays, taken 9-23-36, at the very beginning of his acute lung inflammation, show a remarkable and extensive snow-flaky mottling which simulates pulmonary tuberculosis and is entirely due to the acute inflammatory edema and hyperemia caused by the irritating tunnel gases. Whether these gases come from the dynamite explosion in the heading or from the volcanic decomposition, is not of particular importance or interest to the medical men. The striking feature of the case is the fact that this very extensive congestive process throughout the lungs cleared up so quickly as check x-rays taken on 9-25-36, (two days after the first picture) show an unusual clearing and absorption of the process.

Such striking changes in the x-rays over a two-day period would never occur in any other type of lung pathology such as tuberculosis, pneumoconiosis, or any of the pneumonias. It is only with such an acute gas irritation and inflammation with edematous congestion, that such a subsiding and abrupt change could possibly take place.

One of the chief questions in this type of case is whether or not such a gas bronchitis is predisposing to tuberculosis. With this patient, with such a

striking x-ray picture of acute pulmonary pathology, and one with a normal resistance who made a quick and complete recovery, there was no evidence to the effect that such an acute gas inflammatory process would, in itself, be a predisposing factor to tuberculosis. It would seem then that a lowered general resistance that might follow such an acute gas bronchitis would be the chief deciding factor as to whether or not a patient might later develop an acid-fast condition.

Fortunately, in this case, the cause of his lung pathology was quickly discovered and eliminated. Also, the patient was prevented from returning to the same environment, as it was felt that he had not only suffered from gas irritation of the lungs, but, also, very probably, was hyper-sensitive to such irritating gases, as a checkup of ventilation conditions in the tunnel showed that all requirements were entirely satisfactory with the Bureau of Mines.

The crux of the question in any case of lung gassing is, then, not the particular acute pathology resulting from the gassing, but rather that the patient will practically always have no after-complications depending entirely upon his level of resistance. In other words, if the patient's physical condition is up to par, the acute gas inflammatory process in the lungs does not preclude to later complications with tuberculosis. It is advisable, however, in such a type of case, to prevent the affected individual from ever again coming in contact with the tunnel gases, and also it is advisable to have him avoid working in high altitudes, namely, over 5,000 feet.

Complete aeration of the lungs with both carbon dioxide and oxygen in order to increase the vital lung capacity and to overcome the anoxemia produced by the acute inflammatory bronchial findings, seems to be the method of choice in the treatment of such conditions. Also, complete bed rest, nourishing and high caloric foods are important factors in treatment. Diathermy over the chest is used in such cases because of the marked relief given the patient by this treatment.

Conclusions

A CASE report of acute tunnel gas congestion along with comparative x-ray photographs is presented.

2. Tunnels through volcanic deposits produce irritating gases, which in combination with the non-irritating gases from dynamite explosions are sufficient to produce severe and acute gas poisoning, as evidenced in our case report.

3. Provided that the patient is alive following gas poisoning, it seems that the important factor in any case of lung gassing is not the acute pathology that is so strikingly present immediately following the attack, but rather that the patient will practically always have no after-complications if his level of resistance is within normal limits.

4. If the patient's resistance is good, a normal convalescence is to be expected, if immediate and proper treatment is given the patient.

5. There is no evidence that acute gas poisoning of the lungs, per se, precludes to later tuberculosis if the resistance of the patient is maintained at a normal level.

6. It is believed that the x-ray findings as evidenced in our photographs are entirely due to an acute hyperemia and edema around the lung bronchioles, which edematous patches produce the snow-flaky mottling in the x-ray picture.

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Burn Therapy

—*Some Physiologic and Pharmacologic Aspects*—

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CURRENT burn therapy divides itself into two major classifications: leatherizing and non-leatherizing. We do not use the term "leatherizing" in an opprobious sense, but in order that we may more clearly present to the reader the physiologic differentiation between the two systems.

The structure of skin is best described when we view it not as a unity, but as two entities intimately connected as to position, purpose and function. The outer structure we call the epidermis. It is composed of several strata, but only two need be mentioned here; the cuticle, or most exterior, and the malphigian, or most interior stratum of the epidermis. Immediately under the stratum malphigii we find the corium, or cutis vera (true skin) and it is to these two morphologically distinct structures that we refer when we use the term "skin."

All of the various skin strata are permeable to water except the outer stratum corneum, or cuticle. This is impermeable except through the glands or follicles originating in the cutis vera, and upthrust through the cuticle. None of the strata above the malphigian can reproduce themselves, but new cells are constantly formed in the rete mucosum and cutis vera and these extrude upward to replace effete or injured cells in the superficial strata.

The human organism is so adjusted that there is

always a greater tension within its tissues than that of the air which surrounds it.

From these physiological premises we deduce the theory that whenever the integrity of the cuticle is impaired the aqueous fluids contained in the tissues will escape therefrom, and that although the skin strata above the rete mucosum are totally destroyed they will be replaced in kind by the vicarious cell production in the deeper strata.

All skin tissues contain a large porportion of collagen, the physiological form of gelatin, and tannic acid unites with, or "precipitates," all such tissues. It is this property which enables it to convert skin or hides into leather, which can be chemically referred to as gelatin tannate.

The epidermal portions of the skin contain relatively low percentages of this albuminoidal protein and a considerable proportion of keratin which does not readily combine with the tanning acids. Consequently the action of tannic acid on the cuticle is much less emphatic than upon the deeper layers. The extent of this difference may be illustrated by stating that the application of a 5% solution by means of saturated gauze to unbroken cuticle for five minutes does not cause any observable lessening of cell viability. But if the same solution is applied for the same period to skin from which the cuticular stratum has been removed a complete and irreversible necrosis is effected.

Chemically considered, the fatty (lipoid) part of animal tissue is a combination of acids — chiefly stearic — and glycerin. By the dehydration of glycerin (ol) we can produce an aldehyde, called acrolein, which is excessively irritating to nerve and flesh tissue.

THE relevancy of all the foregoing data will become apparent as we go into the pharmacology of leatherizing and non-leatherizing burn therapy, and we will now develop this phase of our subject by a very brief excursion into burn pathology.

When skin is injured by heat some epithelial cells are killed and some are injured. The extent of necrosis and injury is, of course, relative to the severity of the burn, and the localization of burn trauma varies with the nature of the burn agency. In a flash or flame burn, there is always a great preponderance of death and injury to the epidermis. In contact and acid burns injury to the germinal layers may be co-extensive with that of the epidermis, while in x-ray burns the trauma is greater in the cutis vera than in the epidermis.

As the cuticle is the only part of the skin quite impermeable to aqueous fluids the degree of anhydremia and of systemic shock is proportionate to the traumatized area and not to the depth of the trauma.

And inasmuch as the leatherizing of the epidermis will greatly reduce the degree of andydremia, the use of tanning solutions is pharmacologically rational for the prevention of body-water loss. But, as it is impossible to leatherize the dead tissue without also leatherizing to some extent both injured and uninjured tissue, repair of the burned areas is thus impeded.[1]

Frederic Taylor[2] says: "The dead epithelium is of course tanned rather rapidly. If the process stopped at this point, the treatment could certainly be termed ideal. Unfortunately with the usual treatment the tannic acid continues to penetrate and tans the underlying viable epithelial cells, the very cells that might have taken such an active part in the regeneration of the surface epithelium."

No other form of trauma is as painful as burn trauma. This is partly due to the exposure of sensory nerve fibres by the destruction of the protective cuticle, but principally to the formation of acrolein[3] as we have previously explained. The pain-producing action of this aldehyde can be immediately and totally obliterated by changing it into its corresponding acid or alcohol. When this toxic influence has been nullified the painfulness of a burn is only that due to trauma and exposure of sensory nerve fibres. Tannic acid, or other tanning solutions, do not affect this substance, and that is why morphine is so generally used by men who employ this form of burn treatment.

A piece of leather is much tougher and resists dissolution or decomposition to a greater extent than the untanned skin from which leather is made. When a burned surface is leatherized all dead tissue is "fixed." [4]That is, it cannot be dissolved, disintegrated or decomposed. Consequently, as new tissue forms it grows under, over and around these sclerosed remnants, and permanent and ineradicable, hideous, blackish-red scar ridges are the result of this. Where the areas of leatherized dead tissue are so large that they prevent normal skin tissue regeneration Nature bridges the gaps with connective tissue, and this accounts for the livid and glabrous patches and streaks which are also permanent and ineradicable.

Burned areas are notoriously susceptible to both endogenous and exogenous infection. In the leatherizing treatment those tissues which are tanned are, of course, rendered immune. But those which are alive become more sensitive to infection because of their partial devitalization and the fact that the leatherized crusts prevent the oxidizing influence of air upon the tissues which they cover.

The ideal method of treating a burn injury would be one which prevented excessive loss of body-fluids, controlled pain, discouraged infection, promoted the elimination of effete tissue and favored rapid and normal tissue regeneration.

We find that the leatherizing treatment is effective in preventing anhydremia; that it does not control pain; that it increases liability to infection, prevents the elimination of effete tissue, and seriously interferes with the production and proper distribution of reparative tissue.

In non-leatherizing burn therapy non-absorbable mineral oils or greases are used to prevent body-water loss. This is not as effective as the leatherizing process and, therefore, when the injury covers a considerable area intravenous saline and glucose injections must be made to replenish the aqueous serums.

Camphor[5] is employed to lessen the severity of pain, as this substance combines with acrolein and destroys its pain-producing quality.

In the matter of antiseptics the physician has a wide range of choice, but loose combinations of iodine and phenol probably are in most general use.

The use of urea and of vitamins extracted from marine livers to stimulate tissue reproduction have lately come into vogue, but there is as yet little positive evidence of their efficacy.

Needless to say, the ideal and perfect burn treatment is still in the future. But we can at least say that an examination of the leatherizing variety of burn treatment in its physiological and pharmacological aspects must convince the unprejudiced that it is distinctly worse than no treatment.

The writer is well aware that many physicians will declare that clinical experience is quite contrary to this conclusion.

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New Books

Review by

David N. Ingram, M.D.

THE ART OF ANESTHESIA, by Paluel J. Flagg, M.D. Sixth Edition Revised. 491 pp., with Foreword by Alexis Carrel.

IN HIS "Sixth Edition Revised," the eminent Pneumatologist brings up to date his masterly "The Art of Anesthesia."

"When the first edition of this book was published, the Great War was raging. Countless numbers of surgical operations were performed near the battlefield, and in the base hospitals. The value of fundamental principles in anesthesia, as well as in surgical technics, was obvious. When the War Demonstration Hospital of the Rockefeller Institute for Medical Research was opened, Dr. Flagg was asked to lecture and demonstrate his technics before the groups of surgeons of the United States Army who studied in that hospital. After the war, Dr. Flagg gave much attention to the problem of asphyxia in anesthesia and developed simplified endotracheal methods to prevent it.

"Later, he evolved direct methods of artificial respiration, which Yandell Henderson has linked with the work of Meltzer, referring to this procedure as the Meltzer-Flagg technic. Thus, Dr. Flagg was led to attack the problem of asphyxia in general — an important problem, because 50,000 people die each year in this country from asphyxia. His work elicited a wide interest, and the Society for the Prevention of Asphyxial Death was formed under his presidency. Then a Committee on Asphyxia was organized by the American Medical Association. Still extending the field of his studies, Dr. Flagg united the disassociated fields of anesthesia, resuscitation and oxygen therapy under the name of pneumatology. Finally, he established a Department of Pneumatology in connection with the Medical Department of the World's Fair in New York."

These first two paragraphs from the foreword by Dr. Carrel place upon this book a seal of authenticity which the work, itself, demonstrates convincingly. Written primarily as an all-embracing text upon anesthesia in every form, for the student of the art and science of Anaesthiology or Pneumatology (the author prefers the latter nomenclature), it, while deprecating the practice of this art by the laity in the guise of technically trained anesthetists and by inference, at least, the advent of the nursing profession into this field, presents a number of chapters for the explicit purpose of instruction of the latter.

Throughout this work the author demonstrates his amazing powers of observation. No detail of general anesthesia is too minute for recording, and a background of enormous experience provides proper evaluation and interpretation. A rare sense of quiet humor pops up here and there, and his firm stand against improper and unsafe practices denotes the author's quiet forthrightness and his uncompromising attitude concerning the inherent responsibilites of the "pneumatologist." With gentle sarcasm he effectively disposes of the "open drop" or the "open pour and stop" methods in ether anesthesia, and points out that in theory gauze is placed over the patients' eyes for protection but that in practice this produces vastly more trauma to cornea and sclera than the ether from which it was intended to protect. Never for a moment is the patient's viewpoint forgotten, and the author's complete integrity and refreshing (for this day and age) naivete are demonstrated by his words: "in such measure as a man spends his efforts in doing good to others, in just such measures will he find peace and contentment within himself" and "novelties in anesthetic agents not unfrequently entail the payment of the supreme penalty. We who are custodians of our patient's safety should never contribute to the risks assumed by treating lightly the reservations of the experienced." Not preacherish at all but pointing out emphatically this reviewer's somewhat cynical attitude that *what the present day medical profession needs most acutely is more cleverness in its conscientious practitioners and more basic integrity in its clever.*

Most refreshing to one who is most thoroughly fed up with the claims of various proponents and manufacturers is the evaluation of the barbiturates and of the various basal anesthetics.

To local anesthetics are relegated their usual treatment, a brief summary which does not pretend to be comprehensive. The inclusion of this portion cannot but serve to detract from the authenticity of the remainder. This writer in conversation with the author deplored the inclusion of that section discussing local anesthesia by regional intravenous injection on the grounds that even in the hands of an experienced operator the risk involved is entirely out of proportion to the possible benefit to be derived and that in the hands of the inexperienced the procedure could be conceived, without any great stretch of imagination, as being little short of murderous in its execution. Admittedly, most of this section is second-hand and was contributed by colleagues whose integrity could not be questioned but whose enthusiasm failed to convey to the author (in the case of intravenous regional local anesthesia) their dire potentialities and hence did not register with him as coming under his own dictum "novelties . . . supreme penalty," etc.

Excluding then, that section upon Local Anesthesia, this current revision of The Art of Anesthesia is a text and reference book of unusual completeness, rare authenticity and unusual value to anesthetists and surgeons alike and should be available at all times. A student's book, it will be found of little value as casual reading.

PALUEL J. FLAGG, M.D., is one of those rare individuals whose quiet enthusiasms are translated into an infinite capacity for detail. The unusual acuteness of his powers of observation coupled with his evident "desire to spread the true gospel" make of him a man to be sought

out and make of his teaching something to which thought and consideration should be given. His study of the behavior of gases in the human system and his coupling of artificial resuscitation in asphyxia, etc., with the art of anesthesia under the heading of pneumatology have provided a much wider understanding in these fields, and have elevated the art to a much higher plane in the minds of the profession, lending at the same time a truer valuation of our professional responsibilities to those who entrust their lives in our hands. Let us heed the admonitions of this conscientious writer and reverse the trend of our thought which has relegated anesthesia to a minor consideration in our various operative procedures and at least become cognizant of the dangers which await our injudicious selection of the particular anesthetic to be given the patient, *not the case*, which we are considering.

Thus, as Dr. Flagg quietly and convincingly pointed out in our interview, will we make of our anesthetic an ally and a helpful factor in our treatment rather than a factor to be combatted and to be feared. An hour's discussion with this author brought home to me the fact, long since forgotten, that the pneumatologist is a consultant and an assistant of high professional ability and great capacity for helpfulness whereas the anesthetist has assumed a position, in my mind, of a technician to do my bidding. The operator has his hands and mind sufficiently engaged with the procedure at hand and cannot competently direct the actions of the anesthetist nor can be, with justice to himself or patient, direct the giving of the anesthetic. Truly, Dr. Flagg has brought home in his book, his articles and his teaching, a truism, and by reason of his diligence and his persistance has emphasized to the profession the necessity of factual consideration of his subject.

Medical Control

—*of Silicosis and Tuberculo-Silicosis*—

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IN DISCUSSING DR. LEROY U. GARDNER'S paper of similar title[1] which he kindly forwarded to me in advance of his appearance on the present program, first let me say that the four general types of lesions of silicosis as described by Dr. Gardner appear to have general acceptance.* In my experience in the Central States we see much more of silicosis as an autonomous disease than one associated with chronic infection or tuberculosis.

The earliest complication of breathing mineral dust in excessive quantities appears to be the so-called "dust pneumonia" as exemplified in the dust storms of the near West. Next follow the early disability and high death rate in acute or rapid forms of silicosis where only a few weeks to a few months often occasion disability and death. Only extreme exposure could produce such results.

In the chronic form of the disease, pneumonia may appear in the first few months, usually bronchopneumonia, after which more or less immunity to this disease appears to follow.

In regard to tuberculosis, my experience follows more closely that reported in recent triennial reports from South Africa[2] where, for example, only two or three cases of "tuberculosis with silicosis" are reported annually amongst an average 18,000 to 22,000 working miners of European origin, where new cases of "simple silicosis" average about 200 per year and new cases of tuberculosis about 25 per year. In the triennial report ending in 1935, among 925 autopsy investigations on the lungs of European miners in South Africa, 553 were found free of silicosis and tuberculosis, 262 to have silicosis without tuberculosis, 93 silicosis with tuberculosis, and 17 tuberculosis without silicosis. The report states that the number of cases originally notified as having "tuberculosis with silicosis," detected annually since 1925-26, has been so small that a record of their future history is of no statistical value so that returns regarding them have been omitted in recent years. This remark refers to Schedule VI in the report in which the number of these cases was as high as 120 new cases for the year 1918-19, dropping thereafter rapidly to 17 to 28 cases annually in the years to 1924-25, and to seven cases in the year 1925-26.

Probably our experience with tuberculosis in silicotics is not as favorable as that reported by Conrozier and Magnin[3] from the Gard Basin of Southern France, viz., three out of 120 silicotics found complicated with tuberculosis; or that reported by Sleeswijk,[4] in Holland, who found but six tuberculosis cases in 963 stone-cutters. Moller,[5] in Denmark, found tuberculosis rare in 798 porcelain workers, and thought these workers were somewhat protected against this infection. It is probable that 5% would represent the prevalence of tuberculosis in our cases.

We have previously reported[6] that of 912 men examined in the sandstone quarries of Lorain County in 1926, the total tuberculosis we found was but 1.9%, which figure checked relatively closely with the tuberculosis statistics of the community, and up to 1932 the tuberculosis records of the County revealed that only five deaths had occurred from this disease among the workers still resident in the County, and but five active cases were on record among them at that time. In the next five years only some 12 to 15 additional cases of tuberculosis were reported among them. A collateral check on the prevalence of tuberculosis in the families of these quarry workers was made in 1934, under Dr. H. P. O'Brien,[7] the County Health Commissioner, in which Mantoux tests on school children revealed rates no higher in quarry villages than for those in neighboring villages except in one group of 40 children between 15 and 19 years of age which ran 57.5% positive as compared with the neighboring village of Oberlin, which ran 41.4%, both figures low when comparable to the usual city rates.

For the year 1936, the annual inquiry made by the Ohio Department of Health[8] of the 21 tuberculosis sanatoria in the State received reports from six institutions ennumerating 11 cases of silicosis with tuberculosis and, among these institutions, that of Hamilton County (Cincinnati) the largest with 635 beds, and Franklin County

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* From the Proceedings of Tenth All Ohio Safety Congress, held under the auspices of the Industrial Commission of Ohio and its Division of Safety and Hygiene, Columbus, April 18-20, 1939, pages 377-380. (Paper presented before the Ceramics Section.)

(Columbus), 210 beds, reported no case of silicosis in any of their tuberculous inmates.

Hence it is very likely that the prevalence of tuberculosis among silicotics is chiefly a factor of the prevalence of tuberculosis in the given community. Nevertheless, it would seem that silicosis is a condition which predisposes to local infection in the lungs, the nature of the infection dependent upon current circumstances. Also, I am sure we see many partially disabled and some completely disabled cases of silicosis in whom neither tuberculosis infection or ordinary infection can be determined by the usual laboratory or clinical methods, and in whom the degree of lung tissue replacement with fibrous tissue, including nodules and conglomerates, impairs aeriation to the apparent extent of being the sole cause of the disability present.

I have seen a number of cases showing no more than an exaggerated linear pattern which, following a cold or an attack of the flu, have developed a pronounced reticular network, as seen in the x-ray, which persists for months, accompanied by considerable disability. Sometimes these take on a pattern resembling miliary tuberculosis but they usually subside and the picture returns practically to its previous condition, although some of the increased reticulation remains.

Where the lung damage can be shown to be due to infection, then correction and treatment must logically be directed against such. The prognosis, however, is not good where infection of any kind is present.

Isolation of those infected, whether with influenza, or the organism of bronchopneumonia, or tuberculosis, should be strictly practiced.

The adoption of an x-ray refinement known as "tomography," which enables particular sites in the depths of the lungs to be more accurately visualized, suggests a considerable advance in diagnosing the nature of possible infection or other process at such sites.

The medical control of silicosis should take into consideration examination centers, mass-screening by chest x-rays, the finding of suitable "other jobs" for those too disabled to pursue their regular trades, provision for suitable recreation, and wholesome mental hygiene. One of the greatest questions to be met is the silicotic with "lost courage" or with a predominance of neurasthenic symptoms, while we shall always have to contend with the malingerer in this field, as in other diseases where any sort of possible compensation is prospective. Hence centers for chiefly objective tests conducted under governmental supervision, probably in cooperation with labor and employer organizations should be thought of.

After disability is more or less complete the medical dispensation considers the prospects of institutional care, change of climate (as, to a low altitude and dry type with high percentage of sunshine), nutritious diet with small and frequent meals to prevent over-stressing the heart and respiration, and, toward the end, symptomatic treatment by drugs, oxygen, etc., to relieve the exceeding distress, cyanosis, and other features associated with extreme shortness of breath, and other complications present.

The small plant — not large enough to organize a medical program — is still a fundamental problem in the ceramics industry, and cognizance of the presence of silicosis is quite recent in the situation.

I quite agree that silicotics should be kept at their jobs as long as possible, without detriment to themselves and others, with stress placed upon the prevention of further dust inhalation and with periodic x-raying and objective procedures to test physiologic capability.

It is probably not well to expose youths under 25 to siliceous dust, but to select workers over that age whose youthful experiences with chest infections have become staid, as may be determined by periodic examinations.

The mixture of other dusts such as lime and aluminum with the idea of mitigating the silicosis hazard is hardly possible in the ceramic industry, as I understand it, but more processes in this industry could undoubtedly be performed wet rather than dry. One objection to lime and aluminum dusts is their tendency to produce upper respiratory catarrh with atrophy of the mucous membrane and, perhaps, perforating ulcers of the septum.

The duration of the activity of silica particles in the pulmonary tissues, uncomplicated with infection, is still problematical but experience would seem to show that such endures not much beyond two years' time, when the pattern becomes fixed. Undoubtedly, also, there is something to Sir Francis Aitkins'[9] observation in South Africa, in 1913, to the effect that the fibrous tissue changes formed as the result of the irritation of dust in the lungs tends to become organized and permeated by newly-formed blood vessels as the years proceed, as a result of which it is in part absorbed and the particles of silica remaining are liberated and carried away in the blood stream.

May it not eventually be possible that our chemotherapists may discover substances which may be administered to the silicotic that will actually dissolve excess hyalin and fibrous tissues as well as nests of increased reticular cells and cells bearing dust? It is, of course, too early to say.

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Industrial Nurse Symposium

THE recent Symposium for Industrial Nurses, presented by the Divisions of Industrial Hygiene and Public Health Nursing of the Illinois State Department of Public Health, was held at the University of Illinois Medical School during the last week of October.

This is the first time in this country that such an undertaking was attempted, and it met with considerable success. The aim was to bring nurses from various industrial establishments together, and carry to them new thoughts and ideas as to how they may increase their usefulness to industry and so improve the medical services for industry.

Many executives saw fit to have their nurses present, as evidenced by the large enrollment. The daily attendance for the three days averaged 118 nurses. On the second morning of the Symposium, three of Chicago's largest industries opened their doors to groups of these nurses in order that they might see how the modern industrial medical service is conducted, and there was much favorable comment from those in attendance. The dinner meeting saw 136 individuals present. Owing to the inability of DR. A. C. BAXTER, Director of the State Health Department to attend, the presiding officer who filled his place was DR. PHILLIP KREUSCHER, Chief Surgeon, Carnegie-Illinois Steel Company.

The enrollment included nurses from Illinois, Ohio, Minnesota, Michigan, Wisconsin, Tennessee, Indiana, Iowa, New York, and Missouri.

One of the papers given at the meeting follows:

The Value of the Nurse

—From the Employer's Point of View—

HARRY GUILBERT,

Director, Bureau of Safety and Compensation, The Pullman Company, Chicago

FEW employers realize how important the industrial nurse is to their business.* Busy executives take the doctor's word for it that a nurse is needed; place her name on the payroll; and then turn her over entirely to the doctor. The employer will tell you that he hired a nurse to administer first aid to injured and ill employees. How true! But little does he appreciate that Miss Blank, R.N., is not only an Angel of Mercy but also an Educator, Personnel Worker, Health and Safety Promoter, and Counselor. It is for this reason that I call the industrial nurse the "Forgotten Woman."

FIRST AID: By the prompt and correct application of her knowledge immediately after injury, the nurse wards off complications and prevents infections, thereby saving the employee many hours of pain, agony, and distress and saving the employer dollars and cents which otherwise would have to be expended for prolonged treatment and compensation claims.

ACCURATE RECORDS: The white and impeccably clean first aid dispensary is a fortress in which is stored every case record. In settling compensation claims, the value of accurate case histories cannot be over-estimated. To the nurse comes the employee's true version of the accident and at this time, the victim will more readily talk than after he has had time to use his imagination and listen to erroneous outside advice.

An alert nurse will instantly recognize a claim which isn't bona fide and will direct her questions in such a manner than any fabrications or loopholes will be revealed. Or better still, she may avert the man's thoughts from the wrong channel and convince him that it would be wiser to get back on the job. If she has some knowledge of the compensation law prevailing in her State, she will make him realize just how much his loss in earnings will be as a result of his absence. By successfully "selling" this point, she not only keeps down compensation costs but also proves a real friend to her patient.

PERSONNEL WORK: The nurse holds a unique position in relation to the worker and the employer; she might be termed a good-will ambassador. It is for this reason that industrial nursing has been recognized as an important factor in industrial relations' service. Through her kindly treatment of the injured employee, she conveys the thought that by making available the services of a trained nurse, the employer is a true benefactor. She also makes worker realize that his employer is due respect and gratitude for the interest taken in his welfare.

The nurse in a plant is usually very well liked and respected by the men. To them, she is a trusted friend. Many who would be reluctant to report to the management, will confide in her about hazardous conditions in their departments, careless fellow workers, and other matters that can be easily ironed out.

The dividend to the employer from the nurse's personnel activities is apparent. In gratitude for the company's concern in his welfare, the employee will display greater interest in his work which, of course, results in increased production.

SAFETY AND HEALTH PROMOTION: One of the greatest opportunities of an industrial nurse for real service lies in the education of employees in the prevention of accidents. First of all, when a man is suffering from the immediate results of an accident, he is in a very receptive mood for safety advice, so by subtle admonitions and clever safety

* Read before the First Annual Symposium for Industrial Nurses, sponsored by the Division of Industrial Hygiene and Public Health Nursing, Illinois State Department of Public Health, Chicago.

pointers she is quietly assisting in solving the company's accident problem. This is where she is particularly helpful to the new employee.

The nurse is the safety representative's aide. From her he receives prompt information on serious cases so that he can conduct immediate investigations. If she notes that an injured man has assumed an uncooperative and arbitrary attitude, she will bring this fact to the safety man's attention, thus assisting him in dealing with the man. Additionally, she is really a "silent partner" on the safety committee. Her reports show what departments need to be encouraged, what types of accidents are most frequent, whether there are too many eye injuries, etc.

Health and safety go hand in hand. A healthy employee is a safer and happier one. In a happy frame of mind, he is alert to the dangers of his job and to the multitudinous details of his task that bring about expert workmanship. The nurse's activities in the promotion of better health are unlimited. Because of their trust in her, the men feel free to discuss with her the symptoms of their physical ailments. I wager that many cases of advanced illness have been averted through her sage advice.

Today when so much stress is being placed upon pre-employment and periodic physical examinations, another opportunity for service is opened to the industrial nurse. Being in such frequent and close contact with the workers, it is she who can best tell whether they are following the doctor's advice by receiving treatment. Too, she is in an excellent position to detect any signs of occupational diseases.

When a plant is confronted with a heavy production schedule, absences are costly. There is no doubt but that the nurse keeps many men on the job who otherwise would be off due to colds, headaches, frostbite, heat attacks, etc.

In my opinion, the nurse's contributions to the company's health and safety problems alone warrant her salary.

Throughout my safety career, I have been more or less closely associated with industrial nurses, and I hope that from the foregoing remarks you have apprehended a little of the respect and high regard which I have for them. I don't think they receive half the gratitude and appreciation they are due. The little intangible things that arise daily, — the advice, tact, and sympathy contributed by these "Ladies in White" in addition to their definite responsibilities make them indispensable in lightening industry's burden.

Chicago Society

THE CHICAGO SOCIETY OF INDUSTRIAL MEDICINE AND SURGERY will hold its first meeting of the Season at 185 North Wabash Avenue, Chicago, at 8:00 P.M., November 13, 1939.

The Program, under the direction of DR. CHARLES DRUECK, JR., Program Chairman, is as follows:

"Operation of Acromio-clavicular Joint Trauma, Its Management and Treatment," by RAYMOND W. MCNEALY.

"Combination Operation for Recurrent Dislocation of Shoulder," by MARCUS H. HOBART, and "Results Following the Nicola Operation," by JAMES J. CALLAHAN.

"Ruture of the Supra- and Intra-Spinatus Tendon," by WILLIAM R. CUBBINS, and CARLOS S. SCUDERI.

"Claims and Legal Problems in Shoulder Injuries," by FRANK R. PEREGRINE, Special Counsellor to the Workmen's Compensation Commission.

All members of the Chicago Medical Society are invited to attend this meeting. Among the guests will be members of the Casualty Adjusters Association of Chicago.

New York Central Surgeons

THE Sixteenth Annual Meeting of the ASSOCIATION OF SURGEONS OF THE NEW YORK CENTRAL SYSTEM will be held at the Palmer House, Chicago, November 16, 17, and 18, 1939. The Program is as follows:

Thursday Morning, November 16:

8:30—Registration and Information Bureau, Red Lacquer Room Foyer, 4th Floor, Palmer House.

9:30—General Meeting, Red Lacquer Room, 4th Floor.
Remarks by President—FRANK E. PIERCE, M.D., Chicago.

10:00—"The Heart in Industry"—ROBERT S. BERGHOFF, M.D., Chicago.

10:30—"The Endocrines in Heart Disease"—JAMES H. HUTTON, M.D., Chicago.

11:00—"Commoner Signs of Organic Nervous Disease and Their Significance"—GEORGE W. HALL, M.D., Chicago.

11:00—Meeting for Oculist members only in Room 11. G. HENRY MUNDT, M.D., Chicago, Chairman.

12:00—General Discussion to be opened by GEORGE P. MYERS, M.D., Detroit, Michigan.

Thursday Afternoon, November 16:

2:00—"High Traumatic Amputation of the Thigh and Treatment of Shock"—WILLIAM E. DELANEY, JR., M.D., Williamsport, Pa.

2:30—"The Acute Abdomen"—RICHARD J. BENNETT, JR., M.D., Chicago.

3:10—"Injuries to the Head"—HARRY JACKSON, M.D., Chicago.

3:40—"Diagnosis and Treatment of Injuries to the Spinal Cord"—LOYAL DAVIS, M.D., Chicago.

6:30—General Reception for members and their ladies in Room 18 on the Club Floor.

7:30—Annual Dinner in the Red Lacquer Room on the 4th Floor.
MR. O. G. BROWNE, General Claims Attorney, Toastmaster.
MAJOR NORMAN A. IMRIE, Speaker.
Music. Good floor show; followed by dancing until midnight.

Friday Morning, November 17:

9:30—"Observations During Past Year in the use of Sulphanilamide"—GORDON B. MYERS, M.D., Detroit, Michigan.

10:00—"Diagnosis and Treatment of Injuries to the Bladder and Urethra"—HERBERT E. LANDES, M.D., Chicago.

10:40—"Fractures of the Upper and Lower Thirds of the Tibia"—WILLIAM R. CUBBINS, M.D., Chicago.

11:20—"Misinterpretations of X-rays of the Spine"—HOLLIS E. POTTER, M.D., Chicago.

11:50—"Fractures of the Spine"—Philip H. D. Kreuscher, M.D., Chicago.

Friday Afternoon, November 17:

2:00—"The Characteristics and Result of Treatment of Pathological Types of Goitre"—Norris W. Gillette, M.D., Toledo, Ohio.

2:40—"The Treatment of Fresh Wounds"—Joseph C. Donchess, M.D., Gary, Indiana.

3:20—"Simple and Effective Ways of Handling Fractures"—Paul B. Magnuson, M.D., Chicago.

Business Session:
Reports of Committees; New Business; Election of Officers; Final Adjournment.

A. A. I. P. & S. Committees

IN FURTHERANCE of the plans being made for the Twenty-Fifth Annual Meeting of the American Association of Industrial Physicians and Surgeons, at Hotel Pennsylvania, New York City, June 4, 5, 6, and 7, 1940, the following Committees have been appointed:

Committee on Local Arrangements: C. H. Watson, M.D., Chairman.

Committee on Publicity: Willis W. Lasher, M.D., Chairman.

Banquet Committee: H. van N. Spaulding, M.D., Chairman.

Reception and Entertainment Committee: J. J. Wittmer, M.D., Chairman.

Committee on Transportation and Exhibits: J. M. Carlisle, M.D., Chairman.

Program Committee: L. A. Shoudy, M.D., Chairman.

Committee on Ladies Entertainment: Mary M. Crawford, M.D., Chairman.

New York State Society

THE Nineteenth Annual Meeting of the New York State Society of Industrial Medicine was held at Hotel Arlington, Binghamton, New York, on October 10, 1939. The meeting was devoted entirely to discussions. An "Information Board" was named in advance for each of the subjects to be considered, and the members replied to questions submitted by those in attendance. This procedure resulted in some very interesting sessions.

During the forenoon "Abdominal Injuries" were discussed by the "Information Board" which included Dr. A. R. Aaron, (Chairman), Dr. J. Sutton Regan, Dr. Walter A. Machemer and Dr. E. C. Koenig, all of Buffalo; and "Some Toxic Gases and Vapors of Industrial Origin," by the Board of which Dr. J. H. Sterner, of Rochester, was Chairman, and Dr. Leonard Greenburg, Director, Division of Industrial Hygiene, State Department of Labor, Dr. W. J. McConnell, Director, Industrial Health Section, Metropolitan Life Insurance Co., and Dr. John Foulger, Director, Haskell Laboratory of Industrial Toxicology, Wilmington, Delaware, were the other members.

In the afternoon "The Relation of Loss of Motion as Interpreted in Percentage of Schedule Loss" was handled by Dr. William Hughes, of Albany, (Chairman), Dr. Ferdinand Schmitter, of New York City, and Dr. Francis J. Haley, of Buffalo; and "Fractures of the Femur," by Dr. E. T. Wentworth, of Rochester, (Chairman), Dr. C. M. Allaben, Binghamton, Dr. R. S. Farr, Syracuse, Dr. A. A. Gartner, Buffalo, Dr. E. K. Cravener, Schenectady, Dr. A. M. Dickinson, Albany, and Dr. A. R. Grant, Utica.

These subjects, as they were developed and discussed at this meeting, will be features of early issues of Industrial Medicine.

Industrial Medicine

INDIANA has joined numerous other states in the legal recognition of occupational diseases, making them compensatory.* We long have anticipated such a step, since modern industry continues to have its health hazards, even though thousands of dollars annually are spent in bringing about better working conditions for employees. And with the coming of these new regulations in our own state, the medical profession has much before it.

We, of course, have for a long time connected certain disabilities as having to do with the nature of the employment of the individual and the profession has done much to bring about the changes necessary to eliminate much of the source of these troubles. But much remains to be done. Intensive studies must be made as to the "how and why" of many occupational diseases. Lines of demarcation must be squarely set, lest we go too far in attributing many physical ailments to industrial causes.

Our medical societies will find it advisable to set up special committees for the study of these cases and our medical schools must immediately recognize that these things exist and must make curricular changes to meet these conditions. As we have said, industry has done much to take the hazard out of many occupations. Some few years ago the match industry awakened to the fact that "phosphorous jaw" was a mighty problem and set about doing something about it. Chemist Franklin Moore was engaged to make an exhaustive research into the subject and finally succeeded in removing the hazard from this great industry.

Numerous other similar examples might be cited along the same lines. Only a few years ago silicosis began to be talked about in medical circles and soon there were almost innumerable cases filed in our courts, the claimants setting forth that they were victims of this disease. At the present writing we do not hear of so many such suits, though of course silicosis remains an industrial hazard.

There is another feature that needs our consideration, that of other employment for victims of occupational diseases. Many of these folk are not economically situated so as to retire from active employment and it is necessary that they carry on for a livelihood.

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* Editorial in *J. Indiana State M. A.*, November, 1939.

Industrial Medicine

Reg. U. S. Pat. Off.

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A Broad Problem

IN CONNECTION with the surveys of the industrial hygiene problems of the States, as they are now being completed one by one (see Dr. Hayhurst's comment, page 467) it is well to emphasize again that in no case should definite conclusions be drawn from the figures presented in any of them as to the extent of actual hazards. The data thus evolved are indicative of "the potentialities of industrial diseases," and their essential purpose is to show that they are of such multitude as to require intelligent study, control, and integrated activities.

In following these important developments it is interesting to note the evolution of terminology regarding the hygiene of working environment and its effect on health. Thus, up to 1914, when Dr. W. Gilman Thompson's textbook on "The Occupational Diseases" appeared, the familiar term was "industrial disease hazards." About that date the term changed to "industrial health hazards" as more appropriate. To any of the terms, "occupational diseases" had to be added to complete the concept, making a cumbersome title, so that about 1924 the broader term "industrial health" was introduced which was soon adopted by the British Industrial Fatigue Research Board which changed over to "Industrial Health Research Board."

It seems logical that a properly skilled observer can judge the probability of occupational diseases, and diseases partly occupational by a more or less careful scrutiny of the workplace environment. This was the "opinionation" method used in the first Illinois survey made in 1910 under DR. ALICE HAMILTON, and especially developed by HAYHURST in the Ohio survey of 1913-15, although a considerable number of medical examinations and some precision determinations were included in both.

However, looking for occupational diseases first really places the cart before the horse. Looking for potential hazards first is more logical. To one who is experienced in relating cause and effect, it is indeed often astonishing, however, that extensive potential hazards exist with so little reflection in disease consequences, e.g., the handling of cyanides in case hardening. This is good evidence of the unusual powers of adjustment on the part of the human body to malefic influences. Nevertheless, experience and careful evaluation indicate that there is very much going on under the surface which does not show as definite occupational disease and only indirectly as occupational influence.

We shall probably not attain a closer estimation of this problem until extensive data are at hand upon another problem — personal efficiency. Thus it is well known that many continue to work, or return to work after a disabling illness or injury, who are bodily and perhaps mentally very inefficient and incapable of making complete adjustments to stresses and strains. This likewise often jeopardizes the health and welfare of fellow beings.

In a word, industrial health implies far more than obvious occupational disease or the outstanding importance in industry of tuberculosis and pneumonia, and a shortened span of life. It is a definitely broad public health problem.

The Dividing Line

IN THIS day when, for reasons of compensation, so many diseases are being imputed to occupational origin, it is interesting to find one in the incidence of which "occupation is without effect." That, as DR. MAYERS says (page 445), is true of scleroderma. Perhaps the time will come when the limitations upon occupational diseases will be more easily defined from a listing of those diseases that are not of occupational origin than of those that are. But a deeper significance remains. And it is that all the diseases which afflict the general population, afflict the 35 to 40% of the general population which, being gainfully employed, is the *employed* population. The turning point, therefore, as between occupational and non-occupational diseases, may ultimately resolve upon the limitation of the employer's duty to pay, and wherever that may be finally fixed, there will the dividing line be drawn. Meanwhile, the emphasis is increasingly upon the prevention of all the diseases that can be prevented, and the immediate recognition and proper treatment of those, such as scleroderma, that seem to require existence before there can be any suspicion of probability.

INDUSTRIAL HEALTH AND DISEASE

The Relationship Which Should Exist Between the Industrial Physician and the Private Practitioner of Medicine

C. F. N. SCHRAM, M.D.,
Medical Director, Tennessee Eastman Corporation, Kingsport, Tennessee

THE TOPIC implies that this relationship is not always what it should be, but it is not my province or intent to enter into any controversy, but rather from my own experience to tell of some of the lessons I have learned on how to cooperate with the family doctors of the employees who have worked in the industries in which I have been, or at least have tried to be, a fellow employee.* As you well know, it is part of the job of the industrial physician and surgeon to supervise a part of the health program of his fellow employees, and in this work, if the relationship between family physician and industrial physician is cooperative, much good can be accomplished. However, I am not here to give you platitudes.

I do not need to review the history of the development of industrial medicine from the "contract doctor" to the present time. I have known "contract doctors" who were just as ethical, honest, and hard-working as any other physician, and they often worked under conditions which made it almost impossible to render efficient service; but we do know that the faults of that system raised a question in the minds of many private practitioners as to whether or not the physician who entered upon an industrial career was just what he should be. I also know that physicians have used their industrial connections to build up a private practice with no thought of really serving in the industrial field.

Nevertheless, industry has a definite need for a physician's service, and in the larger industries that need is being filled by men of the highest type, men who graduate from the best schools, who serve regular internships, and who are ethical.

A. M. HARVEY, F.A.C.S., started with the Crane Company of Chicago in 1896, and is the father of the present safety goggle and the leggings used in industry today. I will not attempt to enumerate the number of eyes that have been saved by the use of goggles nor the number of burns prevented by the use of leggings. L. A. SHOUDY, F.A.C.S., of Bethlehem Steel, is another outstanding man who through his ethical development of the salt and dextrose tablet has saved an enormous loss through making heat prostration a rare industrial casualty. I could go on to give specific instances of the work done by OTTO GEIER, of the Cincinnati Milling Machine Company; J. R. GARNER, of the Atlanta and West Point Railroad Company; LLOYD NOLAND, of the Tennessee Coal, Iron, & Railroad Company; W. A. SAWYER, of the Eastman Kodak Company, Rochester, New York; THOMAS DOBBINS, of Servel, Inc., Evansville, Indiana; R. B. QUINBY, of the Hood Rubber Company; EDWARD C. HOLMBLAD, of American Railway Express; and a host of others whom I could name and tell of their work, but it is unnecessary.

In citing these names and the incidents in the work of the first two, I have portrayed a part of the work of the industrial physician, which is in keeping with the best tenets of the practice of medicine in that it is preventive; and no greater calling has ever entered the mind of man.

There are in the nation over 1,200 industrial physicians; in the South there are 83. DR. J. R. GARNER, of Atlanta, and I had charge of the medical part of the program at the first Southern Safety Conference held in Jackson, Mississippi, in February of this year. After DR. GARNER's talk, I am sure that no one present held any other idea than that good medical service was a part of any safety program irrespective of whether it be public safety or industrial.

Health maintenance is the industrial physician's principal endeavor: through pre-employment examinations, periodic re-examinations, the treatment of minor injuries and illnesses, the enforcement of public health regulations as they apply to the employees of the industry with which he is connected, and control of sanitation, lighting, and health hazards.

Pre-employment examinations are not made with the idea of ruling men out of employment, but with the idea of proper placement. The records of the modern medical department are as confidential as the ones in the private practitioner's office. The private practitioner tells his patient the findings on an examination and so do we, because an examination which reveals a curable or preventable condition is absolutely useless unless the patient's cooperation in the treatment is secured, and he or she cannot cooperate unless the facts are known to the patient. In very serious conditions I nearly always ask the family physician to state the findings for the reason that he knows the patient, the background, and the family history, and is better able to give the patient the necessary facts to secure wholehearted cooperation in treatment and yet not cause a depressive or discouraged state by telling too much.

The periodic examinations are also for the purpose of health maintenance and the discovery of pathologic conditions in their incipiency.

The treatment of minor injuries and minor illnesses, the sanitation control, the supervision of lighting and control of health hazards — all are for the sole purpose of health maintenance.

It has been stated that during the first part of this century there was as much time lost from injury as from illness. Then the safety movement came into being as an organized effort. But the safety movement said: "Don't get hurt." It did not say: "Don't get ill." Time lost from shop injury has been reduced 75% and now we have the anamolous condition of about one-half day per employee lost annually from shop injury and from eight to 15 days lost from illness. Some say that this is all due to workmen's compensation laws which made injury expensive. Perhaps, but do we want compensation laws to cover all illnesses? DR. LYMAN FISKE has stated that by the use of existing knowledge illness could be reduced 90%. If we reach any such utopia among industrial employees, it will demand the closest cooperative effort. But if we ever approximate it amicably through working together, we may eliminate the greatest possible source of ill feeling, i.e., legal pressure.

C. D. SELBY, M.D., Medical Consultant, General Motors, has stated: "While industry has no wish to assume responsibility for treatment, compensation acts have obligated employers to furnish treatments for occupational injuries and diseases. Naturally they expect their own doctors to render service and this is usually done. However, the industrial physicians of the type under discussion are moving steadily from surgery to preventive medicine, and the evolution is leaving them dependent upon consultants, who are in reality private practitioners. Incidentally, there is frequently much

* Read before the Tennessee State Medical Association, Jackson, April 11, 12, 13, 1939; published in *J. Tennessee State M. A.*, October, 1939.

to be done by the plant physicians in behalf of employees discharged by consultants as cured before they can be placed satisfactorily back in industry.

"So with the exception of minor injuries and the occupational diseases, which are infrequent, and considering the fact that private practitioners treat the injuries in about 85% of all industries, it is evident that the private practioners are dominant in the care of sick and injured workmen. About all that the plant doctor actually does in this respect is to act as a clearinghouse and to correlate the services necessary to adequately care for employees for whom his management is responsible. In short, he acts as a case-finding agency.

"This trend on the part of industrial medicine to ally itself with private practice in the care of industrial patients should be encouraged. Industrial medicine is an honorable specialty of medicine. It is suggested that the general profession be made more cognizant of its ideals and objectives. As a means toward a better understanding, it is suggested that more medical societies follow the example of the New York State Society in organizing sections in industrial medicine."

The adjustment of this point of legal pressure is organized medicine's problem and not my individual one. In New York State they attempted to solve it by a law giving free choice from a panel who could qualify, and the county societies were asked to pass on qualifications. But they found that the ills of mankind that were alleged to have arisen due to occupation were so varied that no one physician, irrespective of how competent, could possibly render competent treatment service. It is now recognized that that which is needed is a clearing or consultation service, and the ethical industrial physician fits the picture. Curative medicine belongs to the private practitioner. The industrial physician must not run a free clinic in competition. His records should be available to the private practitioner for ethical use in the treatment of an ill or injured patient. The periodic examination records, the Wassermann or Kahn reports, chest x-rays, etc., are frequently very valuable to the physician in treating an employee, whom we have failed to keep well.

L. A. Shoudy, M.D., Chief of Medical Service, Bethlehem Steel, has said: "Sometimes the employee expects too much, in that he expects the physician to care for ills which are not directly connected with the industry or to treat him for an accident which had no connection with his job. At times this presents a difficult situation, but the medical department of any industry should establish the fact that it is there only for the conditions arising in and out of the industry and if a man becomes ill on the job from another cause and it is necessary for him to leave the job, he should by all means be referred to his family physician and the physician in industry should cooperate with the family physician."

In a recent year in a plant in Tennessee employing that year an average of 4,500 employees, 840 patients were referred to their family physicians due to findings on physical examination, and the industrial physicians of that plant were called for bedside consultation on about 50 patients by the family physicians.

I have mentioned only one possible source of friction in this article, and that one beyond the immediate control of the private practitioner or the industrial physician. I have outlined the industrial physician's job and that of the private practitioner and shown how the industrial physician can cooperate with the private practitioner, and the lines of their endeavors do not cross. They can parallel and always will as long as each is honest, conscientious, and ethical. They may disagree at times, but if they are game to work it out as per the rules of the American Medical Association, the relationship will be as it should. The method of pay has nothing to do with honesty, ethics, or laziness.

Irvin Abell, M.D., President, American Medical Association, said: "Medical relationships in industry, as far as the individual physician is concerned, differ from ordinary practice in that the preventive aspects by reason of their clinical and technical complexity are more sharply set apart. In comparison, it can almost be said that industry has produced few new problems on the curative side. Nevertheless, so long as plants and workmen in good majority depend on part-time medical personnel, many physicians will be obliged to administer industrial hygiene on the one hand and continue their customary management of individual patients derived from industry on the other. These dual responsibilities are of first importance and not always realized even in professional circles. For some time to come, any movement to improve or extend industrial health must acknowledge first of all that in speaking of industrial hygiene and physical rehabilitation we are describing the several functions of the same set of practitioners. Indeed on occasion these functions may overlap, yet there is no incompatibility that suitable training and ethical behavior cannot overcome."

If the industrial physician is really on his toes he will have so much to do minding his own business that he will be glad to stay off the preserves of the private practitioner. This does not mean that he cannot contribute to the general betterment of medicine of his community through the hospital staff meeting, the county society, etc. He should be accepted as per his ability as a physician working in a special field. The 1,200 of industrial physicians of this country are not mere "finger wrappers" or "first-aiders." But they are real men doing a real job and no more prone to listen to that which the "patient said you said" and draw conclusions therefrom than is anyone else.

Under the present status of workmen's compensation laws, the cooperation that the private practitioner can render the industrial physician is to refer injuries arising in employment back to the industrial physician. He may ask you to treat the case or he may not, as per the various factors involved, but you will win his cooperation.

Again quoting Dr. Irvin Abell, of the American Medical Association: "Organized medicine reaffirms its conviction that no industrial health system can ever be considered worthy of that name unless the worker himself is constantly upheld as the central object of all effort, all planning, and all reform. As long as this attitude prevails and reflects a single-minded purpose, then can labor, management, the government and all elements within the medical profession meet on common and substantial ground."

May I close with a statement which will bear repeating? The best interests of the patient are paramount, and the interest of the private practitioner of medicine and of the industrial physicians in that patient are parallel. They do not cross.

Discussion:

Dr. A. A. McMahan (Memphis): Dr. Schram has very strikingly pointed out the benefits that may be given employees in industry by careful medical supervision. It is especially significant to note that time off from shop injury has been reduced 75% as a result of the safety movement which has proved so effective in the saving of life and limb.

My own experience in industrial practice has been almost entirely limited to the injury side. Naturally, in a not inconsiderable phase of this type of work I have frequently enlisted the help of my fellow physicians. The industrial surgeon encounters almost every type of injury from the simplest to the most severe. He faces problems that require sound judgment and not infrequently the aid of skilled specialists. When consultations are necessary such should result in full cooperation directed toward giving the ill or injured employee the best possible result in any given case.

In the care of my own injury work I have found my relationship with fellow practitioners cordial and helpful. It seems to me there should be no cause for distinction in the industrial field of medicine or surgery that should conflict in any way with other branches of medicine.

The compulsory physical examination periodically required by employers has proved to be of inestim-

able value to employee and employer alike. More and more this requirement is being adopted by business generally as a worth-while step in preventive medicine.

The relation of the industrial physician and his brother physician in other fields should be and can be friendly and cooperative. By this means lives will be saved and a greater number of the ill and injured returned to a gainful occupation.

DR. C. F. N. SCHRAM (closing): I did not mention in this paper anything about the cost, and you may wonder why industry is so interested. Lost time from industry, irrespective of the cause, costs the employer from one to five times as much as the employee loses in wages if the employee is on productive work. If he is on non-productive work, the employer loses as much as the employee loses. There is an average of from one to five times as much time lost from illness as there is from injury. It is easy to figure up the cost to any concern employing 500 to 1,000 men. The major cause of lost time in industy is illness.

May I close with a quotation from DR. ROSCOE L. SENSENICH, of South Bend, Indiana? I took this from the Industrial Health Council Meeting: "Industrial medicine will be respected in proportion as it will apply itself to the advancement of accident prevention and the maintenance of the health of the worker within the boundaries of industry, provided the material interests of industry are not permitted to introduce between the industrial surgeon and his employee patient elements prejudicial to the best interests of the employee and inconsistent with the ideals set up for private practice."

Nursing Service for the Small Plant

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THE problem of health service for employees in small industries has become a matter of concern not only to health authorities but to workers and their employers as well.* It is estimated that in this country there are 15 million people who work in manufacturing, mechanical, and mineral industries. Of the more than eight million persons employed in manufacturing plants, 62% are working in establishments employing less than 500 persons.[1] Most establishments of this size cannot afford to employ a full-time physician. Even employment of a full-time nurse seems impossible for many.

The Committee on Healthful Working Conditions of the National Association of Manufacturers is one group which has been studying this problem. Its members have become much interested in the possibility of purchasing part-time nursing service from local public health nursing associations to assist with health work in these small plants. The idea is not a new one, of course, since a few visiting nurse associations have served industrial establishments in this way for years. However, because of the increased interest now shown in the health of the worker, the time seems propitious for an extension of such activities by public health nursing associations. Some local agencies, realizing this opportunity for service, have asked the National Organization for Public Health Nursing for suggestions.

As a first step toward advising member agencies, it seemed wise for the N.O.P.H.N. to collect information from organizations that have had experience in this field. A letter was sent to all those whose reports for 1937 had indicated that they had any income from service rendered to industry. Replies received from 22 of the member agencies that are now giving industrial service seem of sufficient interest to share with others who may be considering contracts with industrial concerns.

The first question asked of the agencies was this: Is the service which you give rendered within the plant, in homes of employees, or both? Nine agencies replied that services are limited to home visits to sick and injured employees. Occasionally a company pays the nursing agency for visits to the families of employees also. Five agencies reported giving service within the plant only, usually in the form of first aid and follow-up care of minor injuries. The remaining eight reported service both in the plant and in homes of the workers. All 22 agencies stated that nursing care both in homes and plants is given only under the direction of a physician or in accordance with standing orders approved by the responsible physician or group of physicians.

Another question was: On what basis are you paid for these services? Replies show that nine agencies receive compensation on the visit basis, the charge usually being determined by the cost to the agency of making a home visit. One agency receives each year 20 cents for each employee in the industries served; in return the nurses make all the home visits that are needed. Seven agencies that render service within plants are paid on a time basis. Five agencies receive a flat sum each year. Usually this flat sum is based on the number of employees and the service desired, or on an estimate of the time which will be required. Occasionally the amount paid seems to be arbitrarily set by the company served; sometimes the payment is made in more than one way, and for these agencies only the basis of payment of the largest source of income was counted in compiling this summary.

Though not all of the agencies could tell how their industrial service originated, an interesting variety of beginnings was shown. Sometimes the business concern itself initiated plans for service to its employees. More often perhaps it was the public health nursing association that first sought to make the arrangement.

At least on two occasions, employees of the industries concerned were responsible for securing nursing aid. In one company the service started through arrangement with a mutual benefit association. In the other firm the men in the plant asked for an up-to-date first-aid room and the part-time service of a nurse.

Stimulation from an outside source is reported in three instances. In one case this came from a nurse supervisor of an insurance company, and in another from a staff member of the N.O.P.H.N. In the third instance the United States Public Health Service used the local public health nursing association for some home visiting during a study of health hazards in the making of a factory product. When the survey was over the company continued to pay for visits.

Frequently payment for service has been reduced or discontinued in recent years because of the economic depression. Occasionally, however, the depression has been the occasion for securing a contract. Thus, one agency reports that depression conditions and the resultant reduction of personnel caused the closing of the medical department in a local industry; the management then made a contract with the visiting nurse association to supply a nurse at stated hours each week. Another agency reports: "When industrial conditions are good this mill has a full-time nurse; when fair, they buy hourly nursing service from us; when poor, an office employee gives first aid." Still another agency tells of a decision made by an industry to drop its group insurance; but since nursing service available through the insurance plan had proved valuable, the contract for nursing service was made directly with the nursing agency.

Apparently the Visiting Nurse Association of Chicago was the first of the 22 agencies to undertake industrial work. Its first contract was signed in 1903. The program included "first aid and interviews within the plant and visits in homes."

The Visiting Nurse Society of Philadelphia probably has developed the

*In *Public Health Nursing*, September, 1939.
1. BLOOMFIELD, J. J. "The Nurse and Industrial Hygiene." *Public Health Nursing*, November 1938, pp. 648, 649.

largest industrial service, though it only began this type of work in 1932. Five plants are served at present, but at times the number has been greater. Just now a plan for extension of its work is under consideration. The number of employees in the plants served ranges from 100 to 500 people, and the industries buy from three to twenty hours of service weekly. Payment is planned to cover not only specific service rendered, but also nursing supervision and time used for record work in the visiting nurse office. A supervisor who is experienced in industrial nursing acts as a liaison person and each plant nurse has a substitute prepared to carry on the work in her absence. Services include assistance to the physician with routine physical examinations; follow up for correction of defects; general dispensary service, both surgical and medical; and general health supervision.

A number of agencies reported plans for extension of service when business conditions are better. One states: "When business returns to normal we will write a letter to all plants offering service. In this, we will have the co-operation of the manufacturers' association."

If one can judge from this small sample, the development of service to industry by public health nursing associations will have advantages for all concerned. For the nursing organization it provides an opportunity to give needed service to an important group in the community without additional drain upon agency budgets. For industry it offers an economical way of securing health service from especially prepared health workers. For industrial workers it makes available a health supervision which is now generally recognized to be greatly needed.

Health supervision by well qualified public health nurses can mean much more than just first aid. For example, one agency reports: "After some time and with repeated suggestions, the company was persuaded to insist upon employees wearing protective glasses in certain departments. This safety provision resulted within the first year in more than a 50% reduction of eye injuries from flying steel particles. Thus educational work goes on."

It seems probable that the future development of service from public health nursing associations to industrial concerns will depend upon the education of industrial management concerning the value and economy of such arrangements, and upon the availability in the agencies of nurses who are qualified for industrial work. Public health nurses in industry in addition to their usual public health nursing preparation and familiarity with community agencies need to have a thorough grasp of the techniques of surgical nursing and first aid and some knowledge of industrial hygiene.

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